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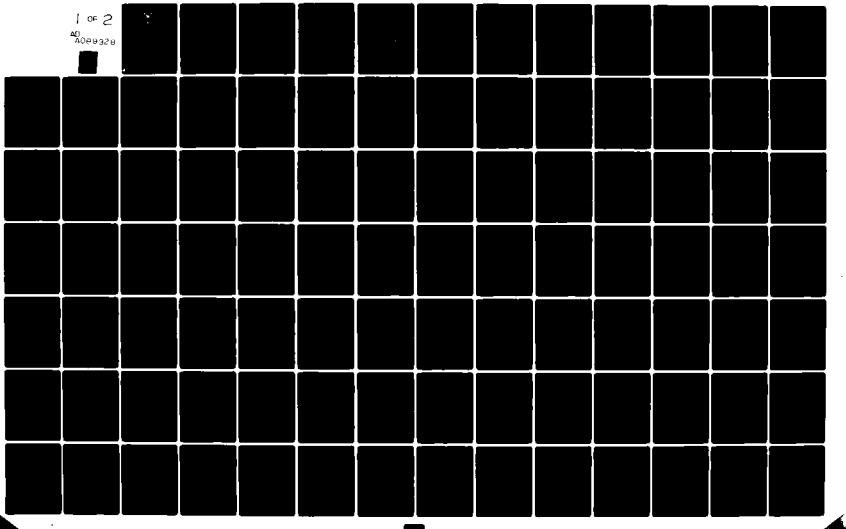

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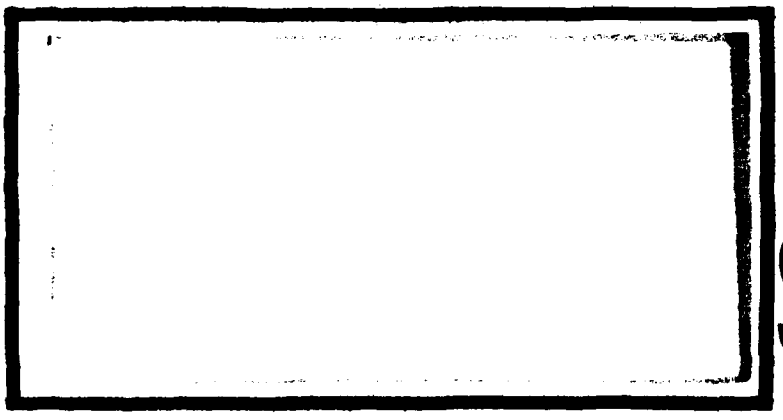

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MULTIPLE MODEL DEMAND FORECASTING COMPARED TO AIR FORCE LOGISTICS COMMAND D062 PERFORMANCE

Todd R. Garland, 1Lt., USAF
Henry P. Mitchell, Captain, USAF

LSSR 61-80

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The purpose of this study was to determine if a multiple model forecasting technique could forecast demand more accurately than the model currently used in the Air Force Logistics Command D062 System for expendable (non-recoverable) items. Simulated and actual data were used to check the results. The methods utilized in the multiple model technique were an eight-term moving average, a four-term moving average, exponential smoothing, adaptive smoothing, a least squares fit and a ratio of change between years method. Results were compared in terms of mean absolute deviation adjusted to show percentage change in accuracy compared to the D062. The statistical test used for comparison was the t-test for matched pairs. This test indicated approximately a seventeen percent improvement in accuracy using either simulated or real data.

LSSR 61-80

MULTIPLE MODEL DEMAND FORECASTING COMPARED TO AIR FORCE LOGISTICS COMMAND D062 PERFORMANCE

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

By

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First Lieutenant, USAF

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Captain, USAF

June 1980

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and

Captain Henry P. Mitchell

has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT
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Chapter 1

BACKGROUND

Inventory

Inventories are commonly employed throughout the economic world. Inventories may be thought of as idle usable resources such as materials, persons, money, or information at some point in time which may be added to or depleted from (2:388). The primary purpose of an inventory is to decouple successive stages in the production-distribution-consumption chain and to thereby permit production or supplier demand decisions to be made independent of supplier procurement decisions (2:389). In more conventional terms, inventory safeguards against variability in delivery and demand. Because inventories represent idle assets, they are reduced to the lowest possible level that management will accept. Lower inventories risk stock-outs, production stoppages, and back orders. On the other hand, high inventories result in high carrying costs and increased risk of obsolescence (17:142).

Inventory Control

Inventory control tries to balance the various risks mentioned. In order to do this, a forecast of future demand must be made. This forecast is seldom based on certain knowledge; rather it is based on the uncertainty of irregular economic cycles, customer demands, and technological advances. Inventory control is confounded by the conflicting demands of manufacturing, marketing, and purchasing. Manufacturing wants ample stock reserves to meet its requirements, marketing desires flexibility and fast response to customer demands, and purchasing yearns for economic lot buying and favorable financial conditions (6:10-11). In the face of these competing demands and in an uncertain environment, the inventory control system must answer the questions of how much to order and when to order it. Regardless of the types of product manufactured, sold, or distributed by organizations, management decisions must be based on an accurate assessment of what has happened and what will happen. In order to do this in inventory control, future demand must be forecast. Statistically based estimates of future demand have been only partially accurate because they are generally based on a measure of central tendency. However, in inventory control there should not be too much inventory for half the time and too little inventory for

the other half of the time. Rather, we must have the right inventory level for all items at any point in time (15:13).

Air Force Inventory Control

As in commercial firms, inventory control is critical to the Air Force. The purchasing, storing, and distributing of inventory is a major budgetary expense in the Air Force, and the limited availability of appropriations necessary to support inventory requirements has increased this problem significantly in the last decade. During the sixties, the Air Force established itself as a leader in the automation of inventory control through the use of an automated inventory control system. The Air Force believed that effective inventory control could determine when to order material and the quantity required through mathematical approaches that can be employed on a computer (6:19,32). The Air Force's use of deterministic models has certainly met with a large degree of success. However, the control of inventory both in the DOD and specifically in the Air Force has considerable room for improvement. A review of the Defense Logistics Studies Information Exchange (DLSIE) Index will quickly reveal literally hundreds of papers involving countless approaches and applications to inventory control issues.

Clearly inventory control continues to be a major challenge. The majority of these studies have common links in methodology, either incorporating a new strategy with an existing strategy of inventory control, or comparing a new strategy against an existing strategy. Forecast accuracy is the critical issue in many of these studies. Nevertheless, no one method of forecasting has been discovered that effectively forecasts all item demands.

At the wholesale (depot) level of inventory control in the Air Force, the quantities of inventory replenishment for expendable items is based on an Economic Order Quantity (EOQ) model. As stated in the Air Force Logistics Command Regulation 57-6,

> the EOQ Buy Computation System (AFLC D062) computes wholesale stock levels and material requirements for all centrally procured items identified by ERRC Codes XB3 and XF3. This system is run at each ALC four times a month using the most current asset, demand, interchangeability and substitution (I&S) and stocklist data, as well as permissive file maintenance by the item manager (IM). The requirements forecasting technique used is based primarily on the demand concept, that is, future requirements are based upon past demands [19:pp.1-1 to 1-2].

The inclusion of "permissive IM file maintenance" allows a quantitative input for factors not based upon past demand or the EOQ methodology. Essentially, this file maintenance input allows the IM to compensate for perceived inaccuracies in item forecasts as well as adding in projected new future requirements. Permissive IM file maintenance is reflected in the Quantitative Requirement portion of the EOQ (QR EOQ)

and is identified by computation Code C. The research team has not used items with QR EOQ since they are a very small part of the inventory, but they are pointed out since they can effect past demand history for individual items. It should be noted that the D062 uses an equally weighted eight-term moving average in its demand computation. This is covered in more detail in Appendix A.

Focus Forecasting

According to Dr. Joseph Bowman of Carnegie Mellon University, "a forecasting system that adapts a series of formulas to item demand will outperform any single-formula forecasting system . . . [15:15]." A new method of inventory control, implementing this concept, was advocated by Bernard T. Smith in his book, Focus Forecasting. The focal point of this strategy to control inventory involves a system utilizing a series of simple forecasting algorithms. The algorithm that produces the lowest percentage of error in forecasting demands when compared to actual demands for inventory items over a period of time is selected by the computer for each line item. The particular algorithm found to be best for each item is used to forecast the inventory needs for the upcoming months (15:3). Smith's method of forecasting demand is executed by computer simulation. When compared against single method models in a commercial application, Bernard Smith's focus forecasting concept achieved greater actual inventory forecasting accuracy.

Problem Statement

The specific problem this thesis explores is whether multiple model forecasting can more accurately forecast demand than the system used by AFLC today. This multiple model methodology has been practical only since the recent increases in computer speed and concurrent cost decreases in cost per performance unit brought on by the commercial use of microcircuitry in computers.

Objectives

The objectives of this paper are straight-forward:

1. To develop categories of demand to typify demands on the AFLC expendable inventory.

2. To compare the results of the multiple model method to the results of the forecasting component of the existing D062 system for each category.

3. To recommend further actions based upon the results of the simulations.

In order to achieve these objectives, categories, algorithms, and programs are necessary. These will be covered in the chapter on methodology in some detail.

Hypothesis

Achievement of the research team's objectives rests upon testing the hypothesis below.

Hypothesis: The multiple model forecasting technique forecasts demand more accurately than the D062 system.

Chapter 2

METHODOLOGY

Overview

The research methodology employed entails the general steps below:

1. Acquiring historical demand data from the DO62 system.

2. Utilizing data in the DO62 forecasting method and the multiple model forecasting method to forecast demands for each item for a three-month period.

3. Comparing the results of the forecasted demands of the DO62 forecasting method, and the multiple model forecasting method, to actual demand data.

By following this methodology, recommendations on the relevance and performance of the multiple model method of forecasting demands can be made.

The DO62 and Multiple Method Models

AFLC DO62 forecasting system. The DO62 forecasting system basically uses a moving average method that

encompasses eight quarters of data. For further detail of the system, reference Appendix A.

These demand rates are then used in an economic order quantity computation by the D062 system (see Appendix B).

Multiple model forecasting method. To forecast effectively, the forecaster must decide which forecast model is the most appropriate in given circumstances (5:245). There may be a variety of models used to forecast a particular demand history. It is clear that certain types of forecasting techniques are more applicable to some types of demand patterns than others (2:97). For example, a simple moving average, simple exponential smoothing, or causal regression model will not normally be well suited to forecasting monthly demand exhibiting strong seasonal effects (2:97). The forecaster should consider utilizing several forecasting methods for a single demand pattern, and after assessing the items to be forecast, select the number of models best suited to a given demand pattern (5:246).

The selection of a forecasting method depends on many factors: the context of the forecast, the relevance and availability of historical data, the accuracy of the forecast, the time period to be covered, and the time available for making the analysis (16:31).

The literature revealed that forecasting experts believe certain types of forecasting models work more effectively with certain patterns of demand than others. More specifically, the literature review indicated that when predicting normal or constant demand, moving average and exponential smoothing are the simplest and most appropriate of forecasting techniques. When forecasting trends, double exponential smoothing, linear growth models, and time series regression forecasting models should be used. For seasonal and cyclical forecasting, base series or the classical decomposition models offer the best forecasting techniques. For irregular demand patterns, experts do not agree on a particular model. Some experts state no one specific model can forecast accurately, while others advocate an adaptive time series method (5:40-41).

The multiple model method used in this thesis research incorporates a combination of strategies recommended by experts (listed above) and other simple forecast strategies. This thesis stresses simple approaches since the researchers concur with Bernard Smith's opinion that unless the users of the system understand what the system is doing, they will distrust it.

Thus, the mathematically sophisticated Box Jenkins, base series, or classical decomposition models were not used to forecast seasonal or cyclical demands. Rather,

Bernard Smith's strategies for forecasting seasonal and cyclical demands will be utilized. For a detailed explanation of the individual strategies employed, refer to Appendix C.

Model selection. The model that forecasts demand most accurately will be selected from those available in the multiple model method. The selection process is accomplished by breaking each demand history into three periods: a base period, a test period, and a prediction period.

The base period is the historical data base needed for each model and, as mentioned earlier, consists of actual demand history. The length of this period varies from model to model. The D062 has a data base of eight quarters, the exponential model implicitly uses all available past history, and Smith's models require from two to five quarters.

Once a base period is established, a forecasting start point is established and each model forecasts demand for a one-year test period. Since this period is the most current past period, actual demands (for this period) are known to the researchers, but not to the model doing the forecasting. The forecasts are compared to actual demand for the test period, and the model with the smallest variation from actual demand is then selected to forecast demand for the next one-year prediction period (15:18-20).

This is a recurrent process in that the forecasting horizon defines a new prediction period; the immediate past prediction period becomes the current test period; the immediate past test period joins the base period data base; and older data is dropped from the base period.

The selection and application of the model producing the lowest percentage of error is done on a recurrent basis for each item. Thus, the model for a given item may very well change from period to period.

Since the prediction period is a sub-unit of an actual demand stream, the accuracy of the multiple model method can be compared to the D062 forecasts.

Comparison method. Comparisons for this thesis were made in terms of units. Comparisons based upon cost are certainly possible, but the sample for such a study would have to stratify cost, while the sample for this study stratified only demand patterns.

Data

This section discusses the source of data, the significance of demand patterns, and the sample size employed.

Data source. The most important requirement of forecasting models is the availability of data. The D062 system maintains data types that record quarterly demand rates for a five-year period.

The data for this study was gathered with the help of personnel from AFLC/ACZRR and AFLC/ACVMS. Reference Appendix E to see the program utilized to compile the data.

Demand patterns. Items were selected for this study that typify the following demand patterns: normal demand (Figure 1), trend demand (Figures 2 and 3), seasonal demand (Figure 4), and cyclical demand (Figure 5) (2:58). This approach was selected because these patterns are analogous to the classical components of a time series (10:611). By using examples that typify each component of a time series, all the classical outcomes have been generalized. For a brief discussion of time series, see Appendix D.

Normal demand is typified by items which lack any decreasing or increasing quantity trends over a period of a year. Trend demand is typified by items with a substantial increasing or decreasing sales activity over several review periods or with an overall sales increase or decrease in consecutive years. Seasonal demand or cyclical demand are representative of items that have a "peak and valley" situation which re-occurs. When items normally have sales restricted to a single month or to a maximum of two or three months per year, they can be considered seasonal. When items normally have sales

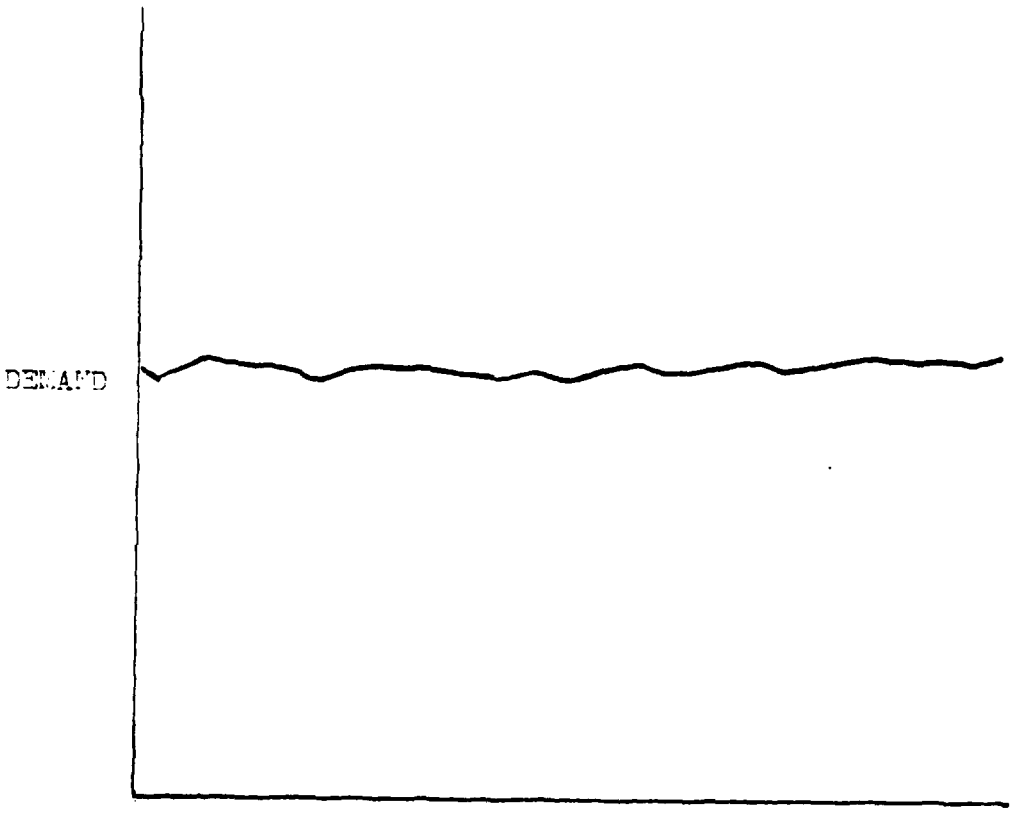


Figure 1

Normal Demand (5:41)

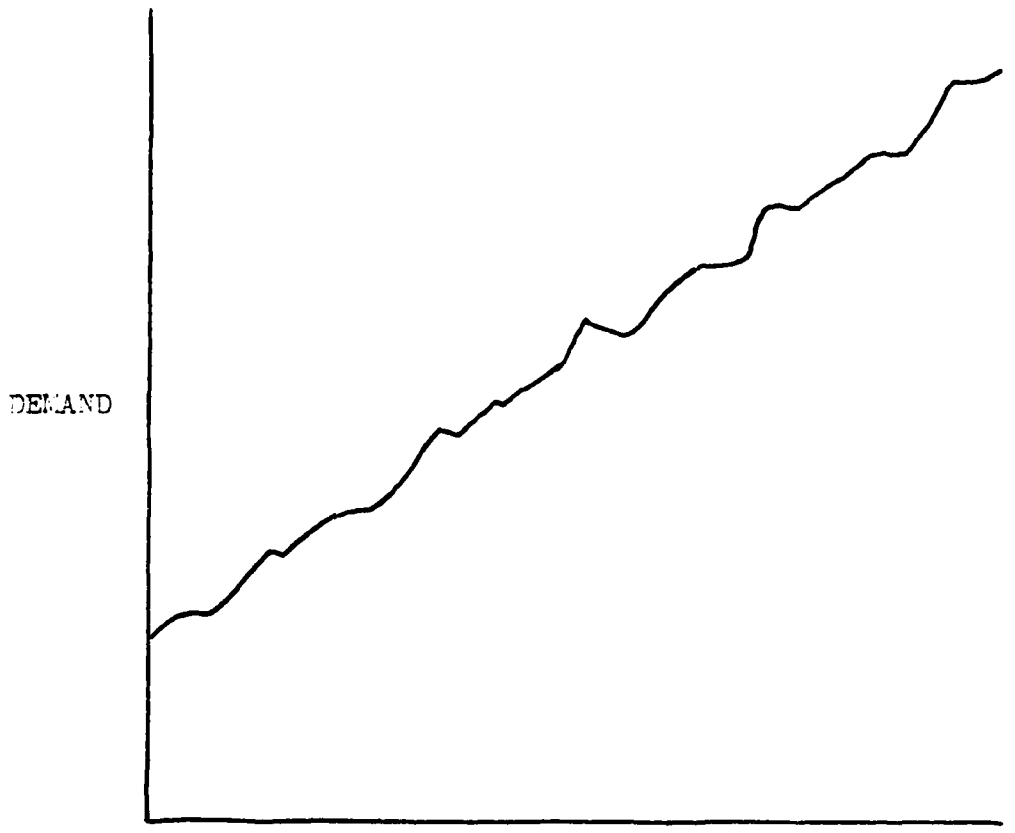


Figure 2

Trend Demand (5:41)

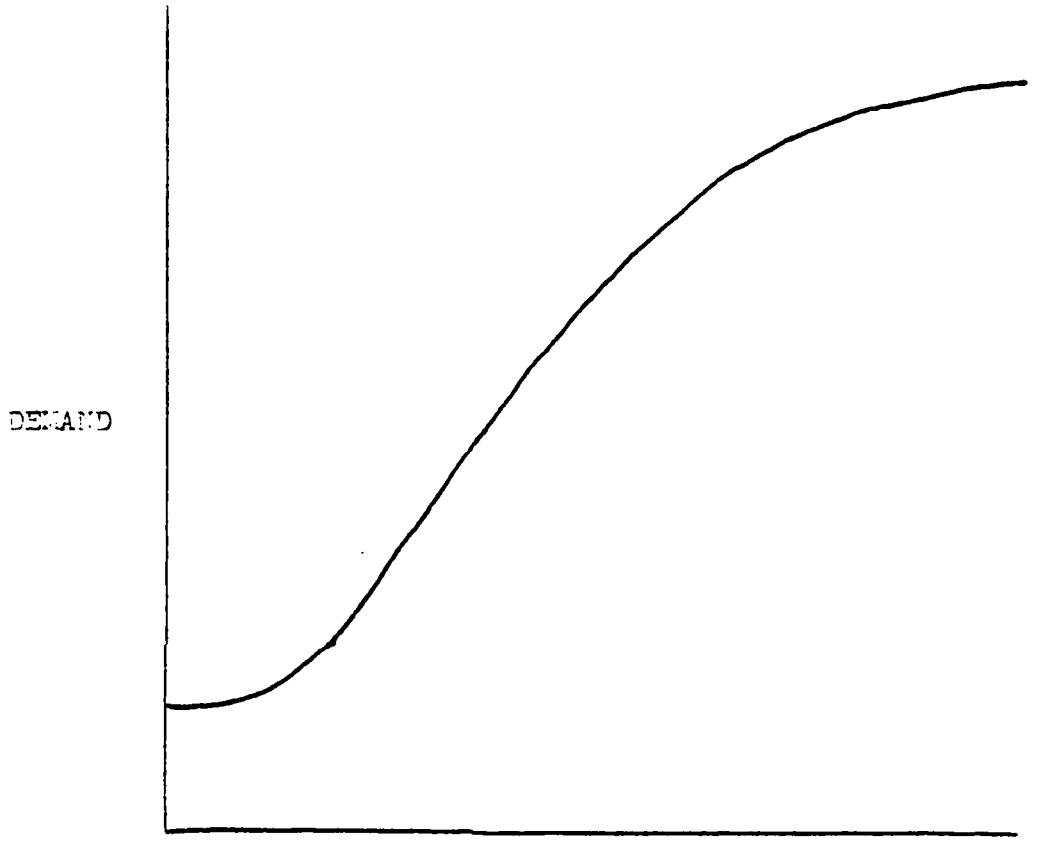


Figure 3

Non-Linear Trend Demand (5:41)

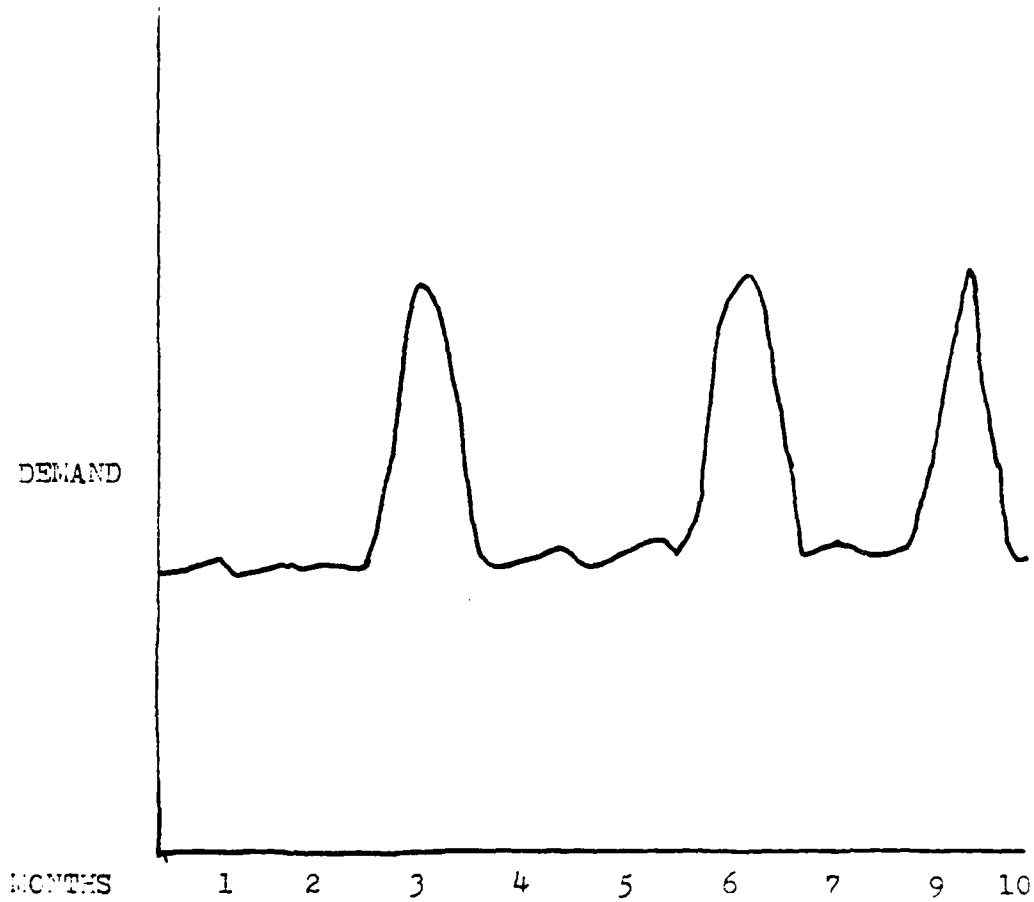


Figure 4

Seasonal Demand (5:41)

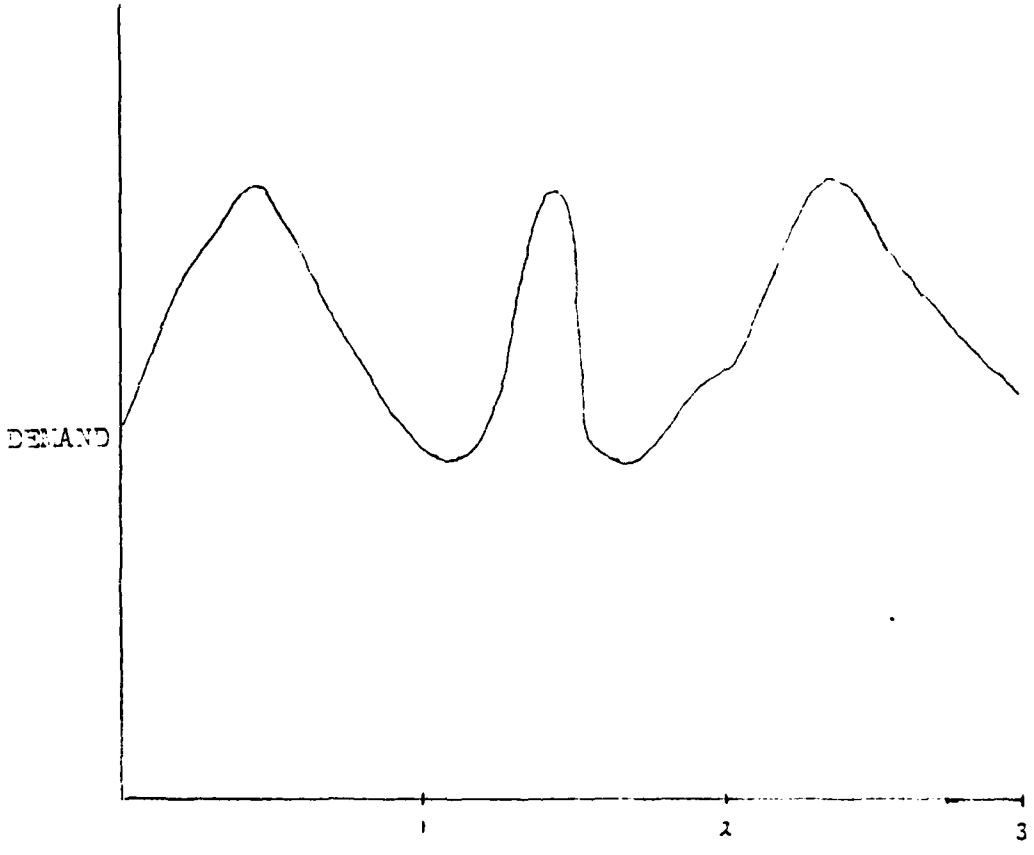


Figure 5

Cyclical Demand (5:41)

that occur over periods of greater than or less than a year, they may be referred to as cyclical items. Seasonality is cyclical behavior with periodicity aligned with the calendar year (8:71-73).

Sample size. Important to any research is the selection of the proper subjects or items of study, referred to as a sample (4:134). Sampling is based on two premises. One is that there is enough similarity between the total population and the sample so that a few individual items will effectively describe the population. Secondly, while certain elements of a sample overestimate the population value, others underestimate it (4:167). Samples are derived from populations which are sets of values that correspond to a characteristic of a universe of items (14).

This thesis research deals with the universe of AFLC D062 Master Items. From this universe a population could be considered as the set of values which are the demand rates on these items over a five-year period (20). From this population (as stated earlier in the methodology overview), sample items were selectively picked from the D062 system that fell into specified demand pattern categories (normal demand, trend demand, seasonal demand, and cyclical demand). If the items were to be randomly selected, literally hundreds of items would have to be

analyzed in order to determine the profile of the universe with regard to demand patterns.

Therefore, the purposive quota sample was to be employed. This particular type of sample selects subjects to conform to predesignated control measures (4:166). The control measures in this thesis research was demand patterns. The sample size, to effectively represent each demand pattern, is strictly a managerial decision. There is no theory or law that states what the correct sample size need be. The size of the sample may be anywhere from one item to hundreds of items to show that the demand patterns do exist (14). To effectively represent each demand pattern, and to utilize each forecasting method, fifteen items were selected from each category for a total sample size of sixty items. This provides a large enough total sample to utilize statistical tests and to make some generalizations. The resulting information is ratio-level measurements of discrete values between the dependent factor (demand) and the independent factor (time in months).

Analysis

For each item, the units forecasted by the D062, units forecasted by the multiple model method, and actual units demanded were known for the prediction period. A mean absolute deviation (MAD) comparing the D062 and

multiple model method was computed. This facilitates the use of statistical tests for matched pairs to determine the accuracy of the two methods (10:320). A significant difference in accuracy allows an inference regarding the aptness of the multiple model method for forecasting demands for expendable items.

Chapter 3

DATA COLLECTION

Introduction

The purpose of this chapter will be to identify the type of data required, its origin, and its validity.

Data Type

Retail or wholesale demand data could have been used to compare multiple model forecasting effectiveness with the effectiveness of a single model system. Wholesale demand data was selected for a variety of reasons:

1. The research was undertaken at Wright-Patterson AFB where wholesale data was available through AFLC Headquarters. Preliminary investigation suggested acquisition of wholesale data would be easier than obtaining retail data. Additionally, individuals having expertise in the D062 system were more accessible to aid in the selection and acquisition of wholesale data.

2. Wholesale data portrays Air Force aggregate demand, and would be expected to illicit demand patterns desirable to support the research objectives of this thesis. Retail data would contain the components of the same demand patterns; however, a greater volume of data would have been needed in order to typify each demand

pattern. This was due to the lower aggregation level and the greater visibility afforded the random patterns associated with that level.

3. Wholesale data incorporates retail data to form the data base currently utilized by the D062 system to forecast demand.

4. Finally, when multiple model demand forecasting proves to be more effective than the D062 system, changes in the current forecasting system would be most readily accomplished at the AFLC or wholesale level.

Data Collection Method

As previously stated in Chapter 2, a purposive quota sample was to be employed. This sample selects subjects to conform to predesignated control measures which, in this research, were the four classical demand patterns. To effectively represent each demand pattern, fifteen items were to be selected from each category, for a total sample size of sixty master items. These sixty items were all to be master items from the universe of D062 items. Obtaining the data necessary to select the sixty master items was to be a multi-step process.

Step one. A computer program was developed (see Appendix F) to extract a list of master item stock numbers loaded on the 2750th Supply Squadron (Wright-Patterson AFB) computer. The list consisted of three thousand plus master

items by stock number, and demand data on each number for the two previous six-month periods.

Step two. Data was not desired for every stock number on the master item list. Based upon information obtained from the list described in Step One, 156 items, that indicated some representation of the demand patterns required, were selected.

Step three. With the help of AFLC/ACZRR and AFLC/ACVMS personnel, a three-part computer program was developed for demand data compilation (see Appendix E). A three-part program was necessary because data format changes have occurred in the past five years. Upon completion of the computer program, the original list of 156 items was submitted with the expectation that demand data for the years 1974-1980 would be obtained for approximately seventy-five percent of the items. One hundred percent return was not expected because stock number changes and deletions over time would cause attrition. However, initial computer runs returned five years of demand data for only thirteen stock numbers.

Problems

There were a number of major problems encountered with the collection of data.

1. The D062 system records demand data on computer tapes. AFLC personnel recently discovered that data recorded on some of the tapes had erroded due to lack of proper care, poor quality tapes, and a high percentage of tapes being creased in handling and storage. Thus, there is no available data for certain periods of time for certain stock numbers.

2. Because this research requires a minimum of twenty quarters of data (five years), the collection and actual retrieval of data was difficult, and sometimes impossible. Original tapes had to be rebuilt, and the computer program required four or five complete runs against each ALC to obtain demand data on the stock numbers.

3. The computer's failure to match stock numbers with demand data on historical tapes insinuated the original list of 156 items were not all master items in the D062 system. Sixty-three additional items were selected using the technique described below. The use of this technique also validated the original list of items. The items on the list of master items received from base supply (over 3,000) were compared to a list of items in the D062 system managed by Sacramento ALC (over 86,000). Items appearing on both lists were selected. The Sacramento ALC was utilized because it had the smallest number of items. The new list of items was then resubmitted

and, when combined with the previous list, run through the D062 history tapes. Again, similar problems recurred while attempting to retrieve the data.

4. Computer time necessary for computer runs to obtain demand data was lengthy. The average run time was three to four hours. Therefore, the program could only be run overnight, rather than during normal duty hours. In addition, the priority of the program was very low. As a result, on some nights it was not run at all.

Data Generation

When it became eivdent that efforts to extract actual demand data were not succeeding, generation of data to simulate demand patterns became necessary. This was accomplished using the DYNAMO simulation program (13). The program generated data which simulated cyclical, seasonal, trend, and normal patterns. Data generated through simulation were entered in the program used for forecasting (see Appendix I).

Actual Data

Without actual data, recommendations comparing the effectiveness of the forecasting component of the D062 system and the multiple model method of forecasting demand could be based only on theory. Following data generation, the authors continued extensive coordination

with AFIT/ACDO personnel and finally partial actual data were received. However, the data were received too late and in too small a number to permit sorting into demand patterns as originally planned. Therefore, the total demand data received (five years for sixty-seven stock numbers from San Antonio and Oklahoma City ALCs) were entered into a common file and input to the developed forecasting program. Actual quarterly inputs received from the D062 system are listed in Appendix H beneath the forecasts computed and are labeled as "raw data." An item number is shown for each string of raw data in Appendix H. Item numbers for data from the D062 system are cross referenced to their stock numbers in Appendix K.

Data Validity

The data recorded on the tapes utilized in this research came from material requirements for all centrally procured items identified by ERRC codes XB3 and XF3 (19:p. 1-2). Since the D062 system is the only source of demand data for master items at the wholesale level, it is considered the most valid source available.

Data errosion on stored tapes and the inability of AFLC personnel to readily access historical data during a six-month time period lead to suspicions regarding the actual data base. However, since both AFLC demand forecasts and the multiple model method employed in this

research were based on this common base, comparisons of relative effectiveness were considered valid.

Summary

In summary, data used for actual analysis were of two types:

1. Theoretic randomly generated data consisting of fifteen cases each for four classical demand patterns (normal, trend, seasonal, and cyclical) as generated by a standard library software package (DYNAMO).

2. A sample of sixty-seven actual item demand historics from Oklahoma City and San Antonio ALCs, which were not selected in a purely random fashion. After the many difficulties involved, the researchers were not able to identify any known bias inherent in the secured data except that only two of the five ALCs are represented. This, of course, does carry certain implied biases.

A discussion of the analysis of the data is presented in Chapter 4.

Chapter 4

DATA RESULTS AND ANALYSIS

Introduction

The attainment of the objectives presented in Chapter 1 depend on testing the hypothesis: the multiple model forecasting technique forecasts demand more accurately then the D062 system's forecasting component.

The first objective, as stated in Chapter 3, was not fulfilled. Demand categories were not developed from the AFLC expendable inventory due to time constraints and unforeseen problems. Therefore, the actual AFLC demand data received were compiled into an aggregate file. However, demand categories were developed for the generated demand data.

The second objective of the thesis was to compare results of the multiple model method to results of the forecasting component of the existing D062 system for each demand pattern. The T-Test for matched pairs was used as the method of comparison. The matched pair's purpose is:

1. To reduce extraneous influences on the variables being measured (in this instance, the mean absolute deviation) and

2. To reduce the effect of subject-to-subject variability, when the magnitude of the treatment effect is near (or less than) sample-to-sample variability (11:270).

Also, unlike many other tests, no assumption of independence between the elements of the matched pairs is necessary. This was important, since the same actual demand underlies each element of a pair.

Data Preparation

Each of the forecasting methods used (see Appendix C) were utilized in all nine quarterly time periods. A mean absolute deviation (MAD) and bias for each method when compared to actual demand was then derived. The following formulas were used in the derivation:

$$MAD = \frac{\Sigma|Forecast-Actual|}{n} \qquad (1:330)$$

$$Bias = \frac{\Sigma(Forecast-Actual)}{n} \qquad (1:331)$$

Each item's MAD for the D062 (eight-term moving average) and focus forecast method were used as a match pair in a statistical T-Test. To compute t, the paired difference variable is formed.

$$D_i = X_1 - X_2$$

where, D_i = Difference between MADs

X_1 = MAD using D062 forecasting technique

X_2 = MAD using focus forecasting technique (10:320)

Prior to the T-test pairs compilation, the mean absolute deviations for the D062 system and the Focus Forecasting system were arranged in matched pairs. The matched pairs represented generated data strings and actual AFLC stock numbers (see Appendix K). The matched pairs from generated data were placed into demand pattern files (normal, trend, seasonal, and cyclical), and also combined to form an aggregate file. The matched pairs from the actual data were placed into an aggregate file (see Appendix J). Because each series of demand data had its own range of data values, the percentage reduction in the mean absolute deviations rather than an absolute reduction is shown. Changing, the mean absolute deviations to percentages required the following computations:

1. The D062 forecast mean absolute deviations were considered 100%.

2. The Focus Forecasting (FF) mean absolute deviations were adjusted to a percentage utilizing the ratio listed below:

$$\frac{\text{D062}}{\text{FF}} : \frac{100}{\text{FF adjusted}}$$

Following the percentage adjustments for the mean absolute deviations, the T-Test for matched pairs was employed.

Data Results

T-test pairs results. The results from the T-Test are shown below. Results from the generated data are listed by demand patterns (normal, trend, seasonal, and cyclical) in Table 1. The results from the aggregated generated and aggregated actual demand data are listed in Table 2. The mean differences in Tables 1 and 2 are expressed in percent of accuracy improvement for Focus Forecasting for positive differences. The sample mean (difference in the adjusted pairs) was computed by utilizing the statistical formula for the T-Test:

$$\bar{D} = \frac{\sum_{i=1}^{n} D_i}{n} \qquad (10:320)$$

The standard error was computed by the T-Tests utilizing the statistical formula:

$$S(\bar{D}) = \sqrt{s^2(\bar{D})} = \frac{s^2_D}{n}$$

where,

$$s^2_D = \frac{\sum_{i=1}^{n} (D_i - \bar{D})^2}{n-1} \qquad (10:320)$$

Confidence interval results. Utilizing the results from the T-Test pairs, confidence intervals were developed. Confidence intervals were employed rather than point estimates because of the desire for an inferential statistic versus a descriptive statistic. Therefore, the authors could infer that, by using the multiple model technique

Table 1

Generated Demand Data T-Test Results

Demand	Mean (Difference in Adjusted Matched Pairs)	Standard Error
Normal Pattern	-22.1133	7.641
Trend	76.3867	3.804
Seasonal	3.2267	5.828
Cyclical	7.6067	7.427

Table 2

Aggregate Demand Data T-Test Results

Demand	Mean (Difference in Adjusted Matched Pairs)	Standard Error
Aggregate Generated	16.2767	5.675
Aggregate Actual	17.4837	4.575

to forecast demand, the percentage of improved accuracy gained for any given item would fall within a statistically computed interval with a certain percentage of confidence. A 90% confidence interval was utilized by the authors.

Two different statistical formulas were required to determine confidence intervals, because the population sample sizes for the generated data and actual data are not the same. For the individual patterns of generated data, the sample size was 15 which necessitated using the confidence interval equation for a normal population:

$$L = \bar{D} + t(1-\alpha/2;\ n-1)S(\bar{D})$$

$$U = \bar{D} + t(1-\alpha/2;\ n-1)S(\bar{D}) \qquad (10:320)$$

For the actual data, the sample size was 67, requiring the confidence interval equation for a large sample:

$$L = \bar{D} - Z(1-\alpha/2)S(\bar{D})$$

$$U = \bar{D} - Z(1-\alpha/2)S(\bar{D}) \qquad (10:322)$$

The results for the 90% confidence intervals are shown by demand patterns for generated data in Table 3. The results for aggregated generated and aggregated actual data are shown in Table 4. Confidence limits represent the percentage of improvement focus forecasting showed (for positive numbers) when compared to D062 performance.

Table 3

90% Confidence Interval for Generated Data

Demand	Lower Confidence Limit	Upper Confidence Limit
Normal	-34.67	- 9.55
Trend	+70.13	+82.63
Cyclical	- 4.61	+19.81
Seasonal	- 5.87	+12.31

Table 4

90% Confidence Interval for Aggregated Data

Demand	Lower Confidence Level	Upper Confidence Level
Aggregated Generated	+6.94	+25.60
Aggregated Actual	+9.95	+25.00

Data Analysis Generated Data

Normal demand data. The results obtained for normal demand data, for a 90% confidence interval, substantiates multiple model forecasting is not as accurate as the D062 system. This is not unexpected since the D062 system employs a moving average forecasting method. Therefore, the D062 system slowly adjusts to demand changes, and where no real change exists beyond randomness about a uniform distribution, the D062 excells by smoothing the effects of the randomness.

Trend demand data. The results obtained for trend demand data indicated multiple model forecasting is far more accurate than the D062 system. The multiple model technique outperformed the D062 system because the D062 system does not adjust to rapid changes in demand. Demand forecasting models that do respond to rapid demand changes were employed in the multiple model technique used in this research.

Cyclical demand data. The results for cyclical demand data indicate the D062 systems will forecast demand more accurately in some instances than the multiple model forecasting technique, but overall, the multiple model technique is more accurate. The same reasoning applied to

the results of the D062 system in forecasting trend demand data can be applied to cyclical demand data. The D062 moving average forecasting system does not readily respond to rapid changes in demand data; but when the cyclical amplitude is relatively small, an eight-quarter moving average can adequately smooth and forecast demand.

Seasonal demand data. The results for seasonal demand data show the multiple model technique is an average of 3.2% more accurate than the D062 system, but does not outperform the D062 in all cases. It must be remembered that seasonal demand data was based on four time-periods of data, and the D062 moving average forecasting systems are based on an even multiple of this period (eight time-periods of data). Therefore, it would be expected that the moving average technique utilized by the D062 system would forecast demand with about the same accuracy as focus forecasting because it averages out the demand data over these time-periods and both methods forecast for a one-year period.

Aggregate demand data. When generated demand data was aggregated, the results showed that the multiple model forecasting was appreciably more accurate in forecasting total demand than the current D062 system utilized by AFLC today. However, the generated data results are only based on a theorized data base. The similarity of results

between aggregated generated data and aggregated actual data suggests an underlying soundness to the concept and method of generating data, as well as suggesting the real data contains similar types of patterns. When compared with the results from actual demand data, one can infer very strongly that the multiple model forecasting technique is more accurate than the D062 system's forecasting component.

Actual demand data. The results from the aggregated demand data closely match that of the aggregate generated data. Examination of plots of the actual data revealed configurations of demand are not always readily discernible. The results infer each demand component was present whether it was readily discernible or not.

Summary

In both aggregated data files (generated data and actual data), an improvement in forecasting accuracy of approximately 17% was found. The use of classical demand patterns as a basis for the generated data, and the similarity of results between the aggregated files, lends credence to the generalizability of the real data despite its rather small size.

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The results of the research and data analysis suggest several conclusions which can be related to the objectives of the thesis.

The first objective of the thesis was to develop categories of demand to typify demand on the AFLC expendable inventory. As previously stated in Chapter 3, demand patterns were not developed for actual data because of time constraints. Yet, the generated data base, structured upon classical demand characteristics, closely approximated the use of real data in terms of overall aggregate results.

The second objective was to compare the results of the multiple method to the results of the forecasting component of the existing D062 system for each category. This was accomplished for generated data but not for actual historical data (see Chapter 4).

The third objective was to recommend further actions based upon the results of the analysis. This objective was the goal of this chapter.

The hypothesis made in order to achieve the objectives was that multiple model forecasting techniques would forecast demand more accurately than the D062 system. Based upon the investigation conducted:

1. The multiple model forecasting technique does forecast, based upon actual or generated demands, more accurately than the single method currently used in the D062 system.

2. Whether the multiple model technique is compared with the D062 system utilizing generated data, or actual data, the multiple model technique shows similar improvements in accuracy.

Recommendations

The third objective of the thesis was to recommend further actions based upon the results of the analysis accomplished. The recommendations considered important to further evaluate the two forecasting systems, and to extend the scope of this thesis, follow.

The focus forecasting technique. The following recommendations apply to testing the multiple model methodology.

1. Additional forecasting methods beyond those models used in this research should be tested. No attempt was made in this thesis to find a model or the models best

suited to the actual demand data. The focus forecasting method does not require any set number of models; rather the method can be tailored to its specific application. Investigation of models appropriate to the D062 could increase the effectiveness of the focus forecasting method beyond that shown in this thesis.

2. Alternative heuristics should also be tested. The authors' heuristic was simply to forecast for one period (year) using the best performing model in the immediate passed period. The multiple model technique should also be tested using two or three-time periods as a decision basis, and then comparing forecasts with the D062 forecasting system.

3. The research should be replicated utilizing a true random sample of actual data rather than the limited available data used for this study. This would enhance the generalizability of the previously mentioned conclusions and permit further insights such as cost effectiveness.

4. Utilize the multiple model of forecasting demand in a test mode for a time-period of one year concurrently with the D062 system. This could be done for one ALC to reduce test costs. This would enable a true comparison of the two forecasting systems to be made, and provide data to substantiate more effectively the authors' conclusions.

The D062 system. The following recommendations apply to the D062 system.

1. The authors feel that actual demand data should be archived by individual months rather than quarters. This would enable demand data forecasting to be accomplished utilizing more variable demand patterns. The D062 uses monthly demand in reaching its quarterly figures (19:p.7-2). Storing data by month would not prohibit quarterly aggregation and would enhance any further research and system effectiveness studies.

2. The current state of archived demand data tapes held by AFLC is a source of serious concern. The problems encountered over a six-month period by those responsible for the archive function raise several questions. Standardization and documentation of data access procedures is clearly inadequate, based upon the researchers' experience. Management attention is necessary if a meaningful historical data base is to be achieved. Without a historical data base, analysis of inventory management effectiveness is not complete.

Demand accuracy and total cost. The following recommendation applies to demand accuracy and total cost.

Research should be undertaken to expand the scope of this thesis to determine if the multiple model forecasting technique incurs a significant cost saving factor by

forecasting demand more accurately than the D062 system. The impact of demand accuracy on EOQ total cost can be shown as the relationship in the classical EOQ model between cost (K) and order quantity (Q) (7:34). The equation is shown below:

$$\frac{K}{K^*} = 1/2 \left[\frac{Q^*}{Q} + \frac{Q}{Q^*}\right] \qquad [7:36]$$

where K* and Q* are the cost and order quantity at optimum levels. From this equation the plot in Figure 6 can be developed. The figure shows a relative flatness in the area of the optimal relationship to the extent that a relatively large error in Q would lead to a rather small change in K.

Assuming that the D062 system utilizes a relatively simple EOQ approach, let D* represent the results of focus forecasting, and D represent the D062 forecast of demand.

Let $D^* = 100$

and $D = 117$

(which corresponds to the findings of approximately 17% improvement in forecasting accuracy). Using the classic EOQ approach,

$$Q = \sqrt{\frac{2DCO}{CH}}$$

where Q = the economic order quantity

D = demand

CO = Order costs

CH = holding costs

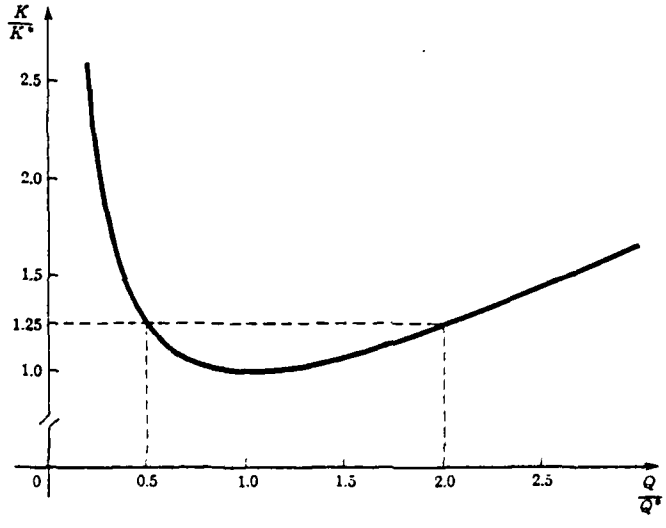


Figure 6. Quantity Error to Optimal Cost Relationship [7:36]

For the given demand values (D and D*), with order and holding costs held constant,

$$\frac{Q}{Q^*} = \frac{\sqrt{117}}{\sqrt{100}}$$

$$= 1.08$$

and therefore

$$\frac{K}{K^*} = 1/2 \left(\frac{1}{1.08} + 1.08\right)$$

$$= 1.003$$

and consequently, little impact would be expected upon total cost. However, the D062 used EOQ year factors, which multiply D by a number between zero and 3.0, to determine the projected volume of total demand for the item (19:pp. 7-11 to 7-13). Thus, the authors suggest that the normally expected small change in cost may well be confounded by the EOQ year factor. If, as an extreme example, 3.0 = EOQ year factor, then

$$\frac{Q}{Q^*} = \frac{\sqrt{3(117)}}{\sqrt{100}}$$

$$= 1.87$$

This equates (using Figure 6) to a 20% difference in total cost which has serious implications for inventory investments.

Currently, there are roughly 650,000 items in the AFLC D062 system. On an end-of-month basis, AFLC produces buy positions for an average of $40 million on these items

(18). Based upon these figures, the total yearly monetary amount spent for inventory control and replenishment equals $480 million. Thus, a .3% cost saving equals $1 million, and a 1.87% cost saving equals $5.52 million. Therefore, this research has not directly attempted to relate demand forecast accuracy to total EOQ cost, but clearly, further research is indicated since deviation from optimal order quantities (Q*) resulting from imperfect forecasts increases cost. Further, the effect of the total imbedded techniques inherent to the D062 system can tend to magnify the variances from optimal buy quantities actually determined. Given the significant resource investment which the D062 system is designed to help manage, continued research is indicated if only to provide periodic validation of the effectiveness of this decision support system.

APPENDIX A

DEMAND

Because this thesis deals with demand histories, particularly those from the D062 system, an understanding of what demand entails is essential.

This thesis research was concerned primarily with demands for expendable (ERRC XB3, XF3) items; thus, the authors used the definition of demand found in AFLC Regulation 57-6.

> A demand is a valid requirement for materiel placed upon the supply system by an authorized customer [19:1-2].

Demand data are accumulated by the D032/34A system prior to being subsequently passed to the D062 system (19:1-2). Demand frequencies considered over a base period (a period of time for which demands are known) can be expressed as a demand rate. To develop the base period for computational requirements, the number of elapsed days in the current quarter must be known (19:p.7-1). Normally the demand rate used by the D062 system is computed as a weighted average (with implied equal weights for terms) of the most recent two years' demands netted by serviceable returns for the same period (19:p.2-1).

AFLC uses a "program monthly demand rate" (PMDR) in its EOQ computation. This PMDR is composed of two components: the AF Monthly Demand Rate (MDR) and a "program ratio."

The MDR is determined as follows:

$$MDR = \frac{DUC}{24}$$

where,

DUC = Last seven quarters of data for which complete data is available, plus the cumulative data available for the most recent quarter times a "remainder factor" which approximates the total demand for the eighth quarter.

This applies only to items with quarter tallies of 8. Formulas for items with quarter tallies less than 8 may be found in AFLCR 57-6 (19:72). This research considered only items with at least twenty quarters of demand data and therefore eight quarters of data were available.

The peacetime program ratio is basically a scalar. All items are assigned a program ratio based upon the item management code. Selective program ratios can be less than or greater than 1.0, and are assigned by HQ AFLC/LOR to items with specific management codes. The standard program ratio is 1.000 and is assigned to all items not assigned a selective program ratio (19:1-2). The program monthly demand ratio, then, is the monthly demand rate times the peacetime program ratio (19:p.7-2). Nearly all items in the D062 are assigned standard program ratios, so normally the Program Monthly Demand Ratio will not vary

from the Monthly Demand Rate. In this thesis, research data will be based on the Program Monthly Demand Ratio.

APPENDIX B

ECONOMIC ORDER QUANTITY

The reason demand forecasting is so important is that it is the common input variable of most ordering systems. This includes the fixed period, fixed quantity, and economic order quantity (EOQ) models. The Air Force controls its inventory through a modified (EOQ) model with the objective being to find the right quantity of material to order at the correct ordering point. The total EOQ in the D062 system is the sum of the Air Force (AF) EOQ and Quantitative Requirements (QR) EOQ.

The AF EOQ is derived by multiplying the program annual rate by the EOQ year factor. QR EOQ is derived by multiplying the EOQ year factor by 4 (19:p.7-3).

The subjectivity of QR EOQ is recognized, but since (only approximately) two percent of D062 items are assigned QR EOQs, their impact is not considered in this paper. Only computation Code B items (AF EOQ) are considered. EOQ in both portions of this formula utilize a standard EOQ formula known as the Wilson Lot Size Formula:

$$Q = \sqrt{\frac{2ACO}{CH}}$$

where, Q = Quantity per order

A = Dollar value of the program annual rate (demand) using actual unit cost

CO = Cost to order

CH = Cost to hold (19:p.7-3)

APPENDIX C

FORECASTING METHODS UTILIZED

Many forecasting techniques have been developed for various systems. Focus forecasting uses some number of methods concurrently rather than using only one method. The methods described in the succeeding paragraphs were used in this research.

The moving average model would be expected to perform well in normal constant demand situations. The moving average method assumes that the data generating process constitutes a time series:

$$F_t = \bar{D} + e$$

where,

F_t = forecasted demand for period t (a random variable)

$\bar{D}$ = the average demand over time (a constant)

e = a random variable with a mean of zero as constant variance over time (8:108)

The moving average technique may be notationally described as

$$F_{t+1} = \frac{D_t + D_{t-1} + D_{t-2} + \cdots + D_{t-N+1}}{N}$$

$$= \frac{1}{N} \sum_{i=t}^{t-N+1} D_i$$

where,

F_{t+1} = Forecast for the next period, t+1

$\sum_{i=t}^{t-N+1} D_i$ = the actual demand at time t, t-1, t-2 . . . t-N+1

N = the number of observations used in the coverage

(4:43)

The moving average method was utilized in two forms: an eight-term moving average (the method utilized by the D062 system), and a four-term moving average. These methods are noted in the output of the forecasting program used as "forecast" and "YL = Y(L + 1)" respectively (see Appendix H).

In forecasting trend demands, exponential models would be expected to perform well (5:37). Exponential smoothing exists in numerous forms. Simple exponential smoothing is a weighting technique whereby more recent data is weighted more heavily in forecasting demands than past data. In other words, these weights decrease exponentially with time. The weights attached to each observation are thus:

$$\alpha D_t + \alpha(1-\alpha)D_{t-1} + \alpha(1-\alpha)^2 D_{t-2} + \alpha(1-\alpha)^3 D_{t-3} + \ldots + \alpha(1-\alpha)^n D_{t-n}$$

where,

D_i = Demands for each period t through t-n (n periods prior to t)

α = A weighting value which lies between zero and one

The sum of the weights equals one, and the weights decrease with age due to the exponent associated with each term. The series is summed and gives the single exponentially smoothed forecast for period t+1. The resulting equation can be expressed as:

$$F_{t+1} = F_t + \alpha(D_t - F_t)$$

Thus, the new forecast (F_{t+1}) is equal to the old forecast plus α times the error in the old forecast. The closer α is to 1, the more the new forecast will incorporate an adjustment for the error in the forthcoming forecast; the nearer α is to 0, the less sensitive the new forecast will be to the error in the prior forecast. The exponential model utilized in this study used an α value of 0.2. This value is well within the range of 0.01 to .3 cited in the literature as most often appropriate (9:63). This method is referred to in the output from the developed forecasting program as "expo smth." (see Appendix H).

A second exponential model utilized, the adaptive smoothing technique, adjusts α over time based upon the magnitude of forecasting error. The same basic equation

holds as cited in the simple exponential smoothing case with the following exception. Rather than being a constant, α is derived from the equation:

$$\alpha_{t+1} = \left| \frac{E_t}{M_t} \right|$$

where,

$$E_t = \beta e_t + (1-\beta) E_{t-1}$$

$$M_t = \beta |e_t| + (1-\beta) M_{t-1}$$

and

$$e_t = x_t - F_t$$

Beta is set at 0.2, the most usual value encountered. E_t smooths the actual errors (e_t), while M_t smooths the absolute error values. Alpha $_{t+1}$ was utilized rather than α_t to try and eliminate over sensitivity in α (9:68). This method is referred to in the output from the forecasting program as "adapt smth" (see Appendix H).

Both exponential and adaptive smoothing techniques had to be slightly modified so that yearly forecasts could be made quarterly. This was necessary so that the forecast period would be one year, and thus compatible with the portions of the D062 system which utilizes the forecasted demand.

A least squares fit approach was utilized as a forecasting technique noted as "Trend" in the forecasting program. This method used the most current eight data points

to derive a regression line by the method of least squares fit. This method finds values for the linear equation:

$$\hat{Y} = A + Bx$$

where,

$$B = \frac{(x-\bar{x})(x-\bar{y})}{(x-\bar{x})^2}$$

$$A = \bar{y} - B\bar{x}$$

(11:323)

This linear function is then extrapolated for a one-year period, values found at each quarter, and these values summed. This method is referred to in output from the forecasting program as "Trend" (see Appendix H).

Bernard Smith found seasonal and cyclical demands closely approximated by a very simple strategy referred to in the forecasting program as Smith #1. The effectiveness of this approach was demonstrated by Smith for an application in the wholesale hardware industry. This method states that whatever the percentage increase or decrease over last year in the past three months will probably be the percentage of increase or decrease over last year in the next three months. To find the forecast for Quarter Six, demand in Quarter Five would be divided by demand in Quarter One, and the quotient multiplied by the demand in Quarter Two. In more general terms,

$$F_{i,j+1} = \frac{D_{i,j}}{D_{i-1,j}} - (D_{i-1,j+2})$$

where,

$D_{i,j}$ = demand in year i, quarter j

$F_{i,j}$ = forecast for year i, quarter j

(adapted from 11:20-21)

Smith also used another simple strategy which proved effective in practice. It states that whatever the demand was in the past three months will probably be the demand in the next three months. In notation, the strategy may be written as

$$D_i = F_{i+1}$$

where, D_i = demand in Quarter i

F_{i+1} = forecast demand in Quarter i+1

(11:20-21)

This method is referred to in the output from the forecasting program as "Smith #1" (see Appendix H).

The last method used, the focus forecast technique, draws on all of the techniques previously described. In each period it finds the method which most closely estimated actual demand, and then utilizes that method to forecast demand for the next period. It is referred to in the output of the forecasting program as "focus forc" (see Appendix H).

APPENDIX D

TIME SERIES ANALYSIS

Any time series, a sequence of observations at equally spaced intervals in time (7:605), can be thought of as being composed of five components. These components are level or normal, trend, seasonal, cyclical, and irregular random fluctuations (9:106). Normal captures the scale of a time series, trends identify the rate of growth or decline of a series, seasonal variations may result from natural forces or man-made conventions, cyclical variations are aberrations between expanding and contracting economic activity, and irregular fluctuations are the residue (9:106).

The classical multiplicative time series model can be represented by the equation

$$Y = T \times C \times S \times I$$

where, Y = dependent demand variable
T = trend component
C = cyclical component
S = seasonal component
I = irregular component (10:611)

An additive model also exists. It uses the same components, but the components are additive rather than multiplicative. The trend component describes the long-term sweep of the series and is usually represented by a smooth curve. In

the context of the demand patterns, "trend" could refer to either normal or trend demand. The cyclical component describes the periods of relative expansion and contraction of more than one year duration and consists of cycles which may vary in both amplitude and duration. Seasonal components describe the pattern of change recurring on a yearly basis. The irregular component describes the effects of all other factors and tends to have an irregular, sawtoothed pattern (7:611). The irregular component can also be referred to as system noise or the random distortion of a seemingly predictable demand pattern (11:xiii).

Any time series mode can be explained by varying proportions of the four components just defined. One would not expect to find abundant real world examples of time series models (demand histories) which are made up of one and only one component of the classical model. However, one should be able to find examples primarily composed of an individual component. For this thesis, the researchers sought to utilize those items that exemplified this attribute. An irregular component of randomized noise was introduced to the generated data by the utilized DYNAMO software package (13).

APPENDIX E

DATA RETRIEVAL PROGRAM

The program in this appendix is a three-part computer program developed for demand data compilation. The program is listed in three parts because data format changes have occurred in the past five years.

PART ONE

```
$       NOTE    SELECT AND SORT RECORDS ON 01 FILE
$       LIMITS  400,25K,,15K
$       SELECT  VRT/DAREFRST
RCDA  M3/15,M253/13,M266/9
$       SELECT  DENNISML/TOGAR-01
FILEISA
SORT  1,15,A
SIZES      7     7SCI
$       LIMITS  180,25K,,10K


$       FILE    IS.A2R
$       FILE    IN,X1S
$       SELECT  VRT/SORTDISK
$       NOTE    SELECT AND SORT RECORDS ON 02 FILE
$       SELECT  VRT/DAREREST
RCDA  M1/15,M38/48,M92/48,M146/48,M254/48,M308/48
$       SELECT  DENNISML/TOGAR-02
FILEISA
SORT  1,15,A
SIZES     43    43SCI
$       LIMITS  180,25K,,10K
```

```
$       FILE    IS,A4R
$       FILE    IN,X2S
$       SELECT  VRT/SORTDISK
$       NOTE    MATCH 01 AND 02 RECORDS
$       SELECT  FORD/DARE
SCISEQ
MATCHM1/2,3/13
MATCHD1/2,3/13
RCDA  M1/2S,D16/240,M29/9
FILEINA
LINES 55,66
HEADA CCT2,"REF LT GARLAND REQUEST D062 80-7"
CTL   B1=1/15
CNTRS C01 = 20 $ 9
CNTRS C02 = 267 $ 9
PRT01 CC01,7S,"STOCK NUMBER - ",1/15,14S
PRT01   "PROGRAM MONTHLY DEMAND RATE - ",C02C/10
PRT02 CC02,7S,"MONTHLY DEMAND RATE - ",C01C/10
PRT02   13S,"PROGRAM RATIO - ",16/1,".",17/3
PRT03 CC02,"QUARTERS ENDING SEP 79 - DEC 77  FIRST   SECOND  "
PRT03   "THIRD   FOURTH  FIFTH   SIXTH   SEVENTH EIGHTH"
PRT04 CC02,"TRANSFER DEMANDS",17S,29/6,2S,35/6,2S,41/6,2S,47/6
PRT04   2S,53/6,2S,59/6,2S,65/6,2S,71/6
PRT05 CC02,"SALES DEMANDS",20S,77/6,2S,83/6,2S,89/6,2S,95/6
PRT05   2S,101/6,2S,107/6,2S,113/6,2S,119/6
PRT06 CC02,"FMS DEMANDS",22S,125/6,2S,131/6,2S,137/6,2S,143/6
PRT06   2S,149/6,2S,155/6,2S,161/6,2S,167/6
PRT07 CC02,"TRANSFER SERVICEABLE RETURNS",3S,173/6,2S,179/6
PRT07   2S,185/6,2S,191/6,2S,197/6,2S,203/6,2S,209/6,2S,215/6
PRT08 CC03,"SALES SERVICEABLE RETURNS",8S,221/6,2S,227/6,2S,233/6
PRT08   2S,239/6,2S,245/6,2S,251/6,2S,257/6,2S,263/6
PRT11 CC01,"    "
PRTF1 CCT0,"    "
$       LIMITS  15,25K,,10K
$       FILE    HS,X1R
$       FILE    DT,X2R
$       FILE    T1,X3S
$       ASSIGN  T7
```

PART TWO

```
$       LIMITS  420,25K,,15K
$       NOTE    SELECT AND SORT RECORDS ON 01 FILE
$       SELECT  FORD/DARE
RCDA  M3/15,M233/13
$       SELECT  DENNISML/TOGAR-01
FILEISA
SORT  1,15,A
SIZES       5     5SCI
$       LIMITS  200,25K,,10K

$       FILE    IS,A2R
$       FILE    IN,X19
$       SELECT  VRT/SORTDISK
$       NOTE    SELECT AND SORT RECORDS ON 02 FILE
$       SELECT  FORD/DARE
RCDA  M1/15,M23/48,M77/48,M131/48,M215/48,M269/48
$       SELECT  DENNISML/TOGAR-02
FILEISA
SORT  1,15,A
SIZES      43    43SCI
$       LIMITS  200,25K,,10K
```

```
$       FILE    IS.A4R
$       FILE    IN.X2S
$       SELECT  VRT/SORTDISK
$       NOTE    MATCH 01 AND 02 RECORDS
$       SELECT  FORD/DARE
SCISEQ
MATCHM1/2,3/13
MATCHD1/2,3/13
RCDA  M1/28,D16/240
FILEINA
LINES 55,66
HEADA CCT2,"REF LT GARLAND REQUEST D062 80-7"
CTL   B1=1/15
CNTRS C01 = 16 $ 4
CNTRS C02 = 20 $ 9
PRT01 CC01,7S,"STOCK NUMBER - ",1/15,14S
PRT01   "PROGRAM MONTHLY DEMAND RATE - NOT AVAILABLE"
PRT02 CC02,7S,"MONTHLY DEMAND RATE - ",C02C/10
PRT02   13S,"PROGRAM RATIO - ",C01C/5
PRT03 CC02,"QUARTERS ENDING JUN 76 - SEP 74  FIRST   SECOND  "
PRT03   "THIRD   FOURTH  FIFTH   SIXTH   SEVENTH EIGHTH"
PRT04 CC02,"TRANSFER DEMANDS",17S,29/6,2S,35/6,2S,41/6,2S,47/6
PRT04   2S,53/6,2S,59/6,2S,65/6,2S,71/6
PRT05 CC02,"SALES DEMANDS",20S,77/6,2S,83/6,2S,89/6,2S,95/6
PRT05   2S,101/6,2S,107/6,2S,113/6,2S,119/6
PRT06 CC02,"FMS DEMANDS",22S,125/6,2S,131/6,2S,137/6,2S,143/6
PRT06   2S,149/6,2S,155/6,2S,161/6,2S,167/6
PRT07 CC02,"TRANSFER SERVICEABLE RETURNS",5S,173/6,2S,179/6
PRT07   2S,185/6,2S,191/6,2S,197/6,2S,203/6,2S,209/6,2S,215/6
PRT08 CC03,"SALES SERVICEABLE RETURNS",8S,221/6,2S,227/6,2S,233/
PRT08   2S,239/6,2S,245/6,2S,251/6,2S,257/6,2S,263/6
PRT11 CC01."   "
PRTF1 CCT0,"   "
$       LIMITS  15,25K,,10K
$       FILE    MS.X1R
$       FILE    DT.X2R
$       FILE    IN.A4R
$       RESOUT  TT
```

PART THREE

```
$       LIMITS  400,25K,,15K
$       NOTE    SELECT AND SORT RECORDS ON 01 FILE
$       SELECT  FORD/DARE
RODA  M3/15,M233/13
$       SELECT  DENNISML/TOGAR-01
FILEISA
SORT  1,15,A
SIZES      5     5SCI
$       LIMITS  180,25K,,10K

$       FILE    IS,A2R
$       FILE    IN,X1S
$       SELECT  VRT/SORTDISK
$       NOTE    SELECT AND SORT RECORDS ON 02 FILE
$       SELECT  FORD/DARE
RODA  M1/15,M23/48,M77/48,M131/48,M215/48,M269/48
$       SELECT  DENNISML/TOGAR-02
FILEISA
SORT  1,15,A
SIZES     43    43SCI
$       LIMITS  180,25K,,10K
```

```
$       FILE    IS,A4R
$       FILE    IN,X2S
$       SELECT  VRT/SORTDISK
$       NOTE    MATCH 01 AND 02 RECORDS
$       SELECT  FORD/DARE
SCISEQ
MATCHM1/15
MATCHD1/15
RCDA  M1/28,D16/240
FILEINA
LINES 55,66
HEADA CCT2,"REF LT GARLAND REQUEST D062 80-7"
CTL   B1=1/15
CNTRS C01 = 16 $ 4
CNTRS C02 = 20 $ 9
PRT01 CC01,7S."STOCK NUMBER - ",1/15,14S
PRT01   "PROGRAM MONTHLY DEMAND RATE - NOT AVAILABLE"
PRT02 CC02,7S,"MONTHLY DEMAND RATE - ",C02C/10
PRT02   13S."PROGRAM RATIO - ",C01C/5
PRT03 CC02,'QUARTERS ENDING SEP 77 - SEP 78  FIRST   SECOND  "
PRT03   "THIRD   FOURTH  FIFTH   SIXTH   SEVENTH EIGHTH"
PRT04 CC02,"TRANSFER DEMANDS",17S,29/6,2S,35/6,2S,41/6,2S,47/6
PRT04   2S,53/6
PRT05 CC02,"SALES DEMANDS",20S,77/6,2S,83/6,2S,89/6,2S,95/6
PRT05   2S,101/6
PRT06 CC02,"FMS DEMANDS",22S,125/6,2S,131/6,2S,137/6,2S,143/6
PRT06   2S,149/6
PRT07 CC02,"TRANSFER SERVICEABLE RETURNS",6S,173/6,2S,179/6
PRT07   2S,185/6,2S,191/6,2S,197/6
PRT08 CC03,"SALES SERVICEABLE RETURNS",8S,221/6,2S,227/6,2S,233/6
PRT08   2S,239/6,2S,245/6
PRT11 CC01,"   "
PRTF1 CCT0,"   "
$       LIMITS  15,25K,,10K
$       LIMITS  15,,,10K
$       FILE    MS,X1R
$       FILE    DT,X2R
$       FILE    IN,X5R
$       SYSOUT  DT
```

APPENDIX F

BASE LEVEL ITEM SELECTION PROGRAM

```
490PRT03   "FIFTH",10S,"SIXTH",10S,"SEVENTH",10S,"EIGHT"
500PRT04 CC06,10S,37/6,9S,43/6,10S,49/6,9S,55/6,10S,61/6,9S,67/6,9S,73/6
510PRT04   10S,79/6
520PRT05 CC02,56S,"SALES DEMANDS BY QUARTER"
530PRT06 CC02,10S,"FIRST",10S,"SECOND",10S,"THIRD",10S,"FOURTH",10S
540PRT06   "FIFTH",10S,"SIXTH",10S,"SEVENTH",10S,"EIGHTH"
550PRT07 CC06,10S,85/6,9S,91/6,10S,97/6,9S,103/6,10S,109/6,9S,115/6,9S
560PRT07   121/6,10S,127/6
570PRT08 CC02,55S,"TIS DEMANDS BY QUARTER"
580PRT09 CC02,10S,"FIRST",10S "SECOND",10S,"THIRD",10S,"FOURTH",10S
590PRT09   "FIFTH",10S,"SIXTH",10S,"SEVENTH",10S,"EIGHTH"
600PRT0A CC06,10S,133/6,9S,139/6,10S,145/6,9S,151/6,10S,157/6,9S,163/6
610PRT0A   9S,169/6,10S,175/6
620PRT0B CC02,46S,"TRANSFER SERVICEABLE RETURNS BY QUARTER"
630PRT0C CC02 10S,"FIRST" 10S,"SECOND" 10S,"THIRD",10S,"FOURTH",10S
640PRT0C   "FIFTH",10S,"SIXTH",10S,"SEVENTH",10S,"EIGHT"
650PRT0D CC06,10S,181/6,9S,187/6,10S,193/6,9S,199/6,10S,205/6,9S,211/6
660PRT0D   9S,217/6,10S,223/6
670PRT0E CC02,40S,"SALES SERVICEABLE RETURNS BY QUARTER"
680PRT0F CC02,10S,"FIRST",10S,"SECOND",10S,"THIRD",10S,"FOURTH",10S
690PRT0F   "FIFTH",10S,"SIXTH",10S,"SEVENTH",10S,"EIGHTH"
700PRT10 CC02,10S,229/6,9S,235/6,10S,241/6,9S,247/6,10S,253/6,9S,259/6
710PRT10   9S,265/6,10S,271/6
720PRT11 CC0T," "
7100:LIMITS:15,,,10K
7200:FILE:MS,A1R
7300:FILE:ST,W2R
7400:FILE:I1,A3R
7700:SYSOUT:OT
7800:ENDJOB
```

APPENDIX G

FORTRAN FORECASTING PROGRAM

The program in this appendix forecasts demands using each of the methods described in Appendix C. It also computes the mean absolute deviation and bias for each method when compared to results from the method used in the D062. Output from this program is contained in Appendix H.

```
10C
20C THIS PROGRAM COMPUTES DEMAND FORECASTS USING SEVEN DIFFERENT
30C TECHNIQUES. ANALYTIC COMPUTATIONS ARE MADE FOR PURPOSES OF
40C COMPARING TECHNIQUES AND FORMING A BASIS OF A RECOMMENDED
50C PROCEDURE FOR MORE EFFECTIVE DEMAND FORECASTING.
60C
70 CALL ATTACH(11,"R1;",3,0,,)
80 DIMENSION Q(20),F(12),A(12),S(12),AL(9),X(9),B(9),ER(15),ERQ(15)
90&,ERA(15),ERQA(15),ET(15),ETQ(15),EM(15),EMQ(15),ALP(15),ALPQ(15)
100&,FY(15),AT(15),FP(15),AQ(15),FYA(15),FPA(15),FQ(15),AY(15)
110&,FQA(15),R(10),Y(12),BIAS(7),AD(7),VM(9),MS(9)
120&,VAR(9),FF(10),XX(10)
124 ICTR=1
125 DO 198 NF=1,67
140 INTEGER D2,D5,X1
150 REAL N1,N2,N,M
160 12 FORMAT(V)
170C
180C  READ DEMAND DATA INTO ARRAY Q
190C
200 READ(11,12)(Q(I),I=1,20)
210C
220C  SET INITIAL VALUES
230C
240 AT(1)=0
250 ALPHA=0.2
260 BETA=0.2
270 ET(1)=0.0
280 ETQ(1)=0.0
290 EM(1)=0.0
300 EMQ(1)=0.0
310 ALP(1)=1.0
320 ALP(2)=1.0
330 ALPQ(1)=1.0
340 ALPQ(2)=1.0
350 DO 400 J=1,15
360 AY(J)=Q(J)+Q(J+1)+Q(J+2)+Q(J+3)
370 400 CONTINUE
380 FY(1)=AY(1)
390 FYA(1)=AY(1)
400 FP(1)=AY(1)
410 FPA(1)=AY(1)
420C
430C  FY=YEAR FORECAST EXPONENTIAL, FP=CONSTRUCTED FORECAST
440C  FYA=YEAR FORECAST ADAPTIVE, FPA=CONSTRUCTED FORECAST - ADAPTIVE
450C  FQ=FORECAST FOR ONE QUARTER EXPONENTIAL
460C  FQA=FORECAST FOR ONE QUARTER ADAPTIVE
```

```
470C
480 DO 410 J=1,15
490 AQ(J)=Q(J+3)
500C
510C  SETS AQ, ACTUAL QUARTER, AHEAD THREE QUARTERS
520C
530 410 CONTINUE
540 FQ(1)=AQ(1)
550 FQA(1)=AQ(1)
560C
570C
580 DO 420 L=1,13
590 IF(L.EQ.1)GO TO 403
600 ERQ(L)=AQ(L)-FQA(L)
610C
620C  ERQ IS ERROR FOR ONE QUARTER...USED IN ADAPTIVE ONLY
630C
640 ER(L)=AY(L)-FPA(L)
650C
660C  ER IS ANNUAL ERROR TERM IN ADAPTIVE
670C
680 ERQA(L)=ABS(ERQ(L))
690 ERA(L)=ABS(ER(L))
700C
710C  ERQA IS ABSOLUTE VALUE OF ERQ, ERA IS ABSOLUTE ER
720C
730 ETQ(L)=BETA*ERQ(L)+(1.0-BETA)*ETQ(L-1)
740C
750C  ETQ IS SMOOTHED ERROR IN ADAPTIVE SMOOTHING, QUARTERLY
760C
770 ET(L)=BETA*ET(L)+(1.0-BETA)*ET(L-1)
780 EMQ(L)=BETA*ERQA(L)+(1.0-BETA)*EMQ(L-1)
790 EM(L)=BETA*ERA(L)+(1.0-BETA)*EM(L-1)
800 ALPQ(L+1)=ABS(ETQ(L)/EMQ(L))
810 ALP(L+1)=ABS(ET(L)/EM(L))
815 IF(EMQ(L).EQ.0.0)ALPQ(L+1)=0
816 IF(EM(L).EQ.0.0)ALP(L+1)=0
820 403 FQ(L+1)=FQ(L)+ALPHA*(AQ(L)-FQ(L))
830C
840C  QUARTERLY FORECAST FOR EXPONENTIAL SMOOTHING
850C
860 FQA(L+1)=FQA(L)+ALPQ(L)*ERQ(L)
870C
880C  ADAPTIVE SMOOTHING FORECAST FOR ONE QUARTER
890C
900 FY(L+1)=FP(L)+ALPHA*(A(L)-FP(L))
910C
920C ONE YEAR FORECAST EXPONENTIAL SMOOTHING
930C
940 F(L+1)=FPA(L)+ALP(L)*ER(L)
```

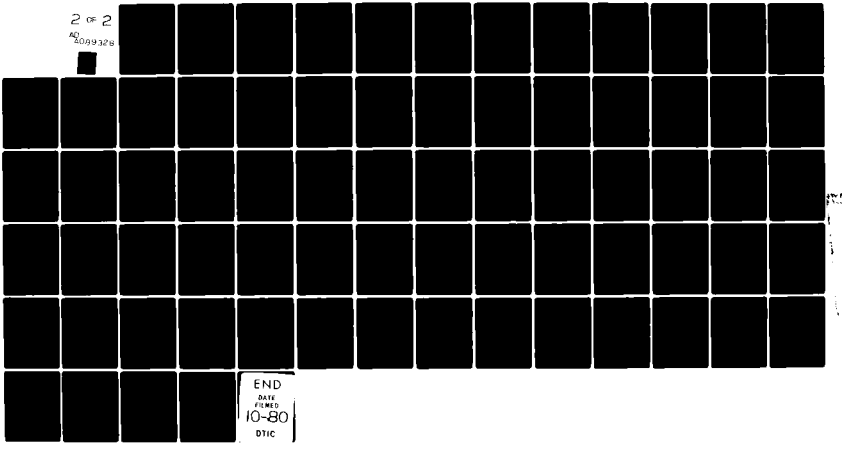
```
950C
960C  FORECAST ONE YEAR ADAPTIVE
970C
980 IF(L.GT.3)GO TO 405
990 FP(L+1)=FP(L)-Q(L)+FQ(L+1)
1000 FPA(L+1)=FPA(L)-Q(L)+FQA(L+1)
1010 GO TO 420
1020 405 FP(L+1)=FP(L)-FQ(L-3)+FQ(L+1)
1030 FPA(L+1)=FPA(L)-FQA(L-3)+FQA(L+1)
1040 420 CONTINUE
1050C
1060C  DO X NUMBER OF FORECAST PERIODS
1070C
1080 DO 20 I1=1,9
1090C
1100C  COMPUTE 8 TERM MOVING AVERAGES
1110C
1120 J=I1
1130 I2=I1+7
1140 F(J)=0
1150 DO 10 I=I1,I2
1160 10 F(J)=F(J)+Q(I)
1170 F(J)=F(J)/2
1180C
1190C  COMPUTE ACTUAL DEMANDS FOR A YEAR PERIOD
1200C
1210 I3=I1+8
1220 I4=I1+11
1230 A(J)=0
1240 DO 30 I=I3,I4
1250 30 A(J)=Q(I)+A(J)
1260C
1270C  BASE FORECAST ON PREVIOUS YEAR'S DEMAND
1280C
1290 I7=I1+4
1300 Y(J)=0
1310 DO 40 K=I7,I2
1320 40 Y(J)=Q(K)+Y(J)
1330C
1340C  SMITH01, 08/04*05
1350C
1360 I8=I1+3
1370 S(J)=0
1380 DO 50 I9=I1,I8
1390 I6=I9+7
1400 I5=I9+3
1410 I10=I9+4
1415 IF(Q(I5).EQ.0)Q(I5)=1
1420 50 S(J)=S(J)+Q(I9)+Q(I5)+Q(I10)
```

```
1430C
1440C  FORECAST BASED ON TREND FROM LEAST SQUARES FIT (8 PRD. TIME SERIES)
1450C
1460 D1=F(J)/4
1470 D6=0
1480 DO 60 D2=I1,I2
1490 60 D6=D6+D2
1500 Z=D6/8
1510 N=0
1520 M=0
1530 DO 70 D5=I1,I2
1540 N1=(D5-Z)*(Q(D5)-Z)
1550 N2=(D5-Z)**2
1560 N=N1+N
1570 M=N2+M
1580 70 CONTINUE
1590 B(J)=0
1600 B(J)=N/M
1610 AL(J)=0
1620 AL(J)=D1-B(J)*Z
1630 R(J)=0
1640 DO 80 X1=I3,I4
1650 80 R(J)=(AL(J)+B(J)*X1)+R(J)
1660C
1670C  FIND BEST METHOD FOR EACH PERIOD FOR USE IN FOCUS FORECAST
1680C
1690 L=J+4
1695 MS(J)=1
1700 VM(J)=F(J)
1710 VAR(J)=ABS(F(J)-A(J))
1720 IF(ABS((J)-A(J)).LT.VAR(J))GO TO 20
1730 206 IF(ABS(S(J)-A(J) .LT.VAR(J))GO TO 202
1740 207 IF(ABS(R(J)-A(J)).LT.VAR(J))GO TO 203
1750 208 IF(ABS(FY(L)-A(J)).LT.VAR(J))GO TO 204
1760 209 IF(ABS(FYA(L)-A(J)).LT.VAR(J))GO TO 205
1770 GO TO 20
1780 201 MS(J)=2
1790 VAR(J)=ABS((J)-A(J))
1800 VM(J)=Y(J)
1810 GO TO 206
1820 202 MS(J)=3
1830 VAR(J)=ABS(S(J)-A(J))
1840 VM(J)=S(J)
1850 GO TO 207
1860 203 MS(J)=4
1870 VAR(J)=ABS(R(J)-A(J))
1880 VM(J)=R(J)
1890 GO TO 208
1900 204 MS(J)=5
1910 VAR(J)=ABS(FY(J)-A(J))
1920 VM(J)=FY(J)
```

```
1930 GO TO 209
1940 205 MS(J)=6
1950 VAR(J)=ABS(FYA(L)-A(J))
1960 VM(J)=FYA(J)
1970 20 CONTINUE
1980C
1990C  FIND FORECAST VALUES FOR FOCUS FORECAST EACH PERIOD
2000C  NOTE:  ASSUMES BEST FORECAST VALUE SELECTED IN PERIOD ONE
2010C
2020 DO 250 J=1,9
2030 LX=MS(J)
2040 FF(1)=VM(1)
2050 IF(LX.EQ.1)FF(J+1)=F(J+1)
2060 IF(LX.EQ.2)FF(J+1)=Y(J+1)
2070 IF(LX.EQ.3)FF(J+1)=S(J+1)
2080 IF(LX.EQ.4)FF(J+1)=R(J+1)
2090 IF(LX.EQ.5)FF(J+1)=FY(L+1)
2100 IF(LX.EQ.6)FF(J+1)=FYA(L+1)
2110 250 CONTINUE
2120 DO 300 LL=1,7
2130C
2140C  FIND MAD AND BIAS FOR EACH METHOD
2150C
2160 DO 305 J=1,9
2170 L=J+5
2180 IF(LL.EQ.1)XX(J)=F(J)
2190 IF(LL.EQ.2)XX(J)=Y(J)
2200 IF(LL.EQ.3)XX(J)=S(J)
2210 IF(LL.EQ.4)XX(J)=R(J)
2220 IF(LL.EQ.5)XX(J)=FY(L)
2230 IF(LL.EQ.6)XX(J)=FYA(L)
2240 IF(LL.EQ.7)XX(J)=FF(J)
2250 305 CONTINUE
2260C  1 THRU 7 REPRESENT EACH METHOD
2270 AD(LL)=0
2280 BIAS(LL)=0
2290C  AD REPRESENTS MAD
2300 DO 310 J=1,9
2310 BIAS(LL)=(XX(J)-A(J))+BIAS(LL)
2320 310 AD(LL)=ABS(XX(J)-A(J))+AD(LL)
2330 BIAS(LL)=BIAS(LL)/9.
2340 300 AD(LL)=AD(LL)/9.
2350 CALL PARAM(1,120)
```

```
2360C
2370C  PRINT OUTPUT
2371 PRINT 890,ICTR
2372 890 FORMAT("FORECASTS BASED UPON IDENTICAL DEMAND DATA".
2373&56X,"ITEM # ",I2)
2380 PRINT 900,(L,L=1,9)
2390 900 FORMAT(//"QUARTER   ",3X,I2,8(8X,I1),11X,"MAD",12X,"BIAS"//)
2400 PRINT 910,(A(J),J=1,9)
2410 910 FORMAT("ACT DEMAND",9(1X,F8.0))
2420 PRINT 920,(F(J),J=1,9),AD(1),BIAS(1)
2430 920 FORMAT("FORECAST  ",9(1X,F8.0),4X,F9.1,6X,F9.1)
2440 PRINT 930,(Y(J),J=1,9),AD(2),BIAS(2)
2450 930FORMAT("YL=Y(L+1) ",9(1X,F8.0),4X,F9.1,6X,F9.1)
2460 PRINT 940,(S(J),J=1,9),AD(3),BIAS(3)
2470 940 FORMAT("SMITH #1  ",9(1X,F8.0),4X,F9.1,6X,F9.1)
2480 PRINT 950,(R(J),J=1,9),AD(4),BIAS(4)
2490 950 FORMAT("TREND     ",9(1X,F8.0),4X,F9.1,6X,F9.1)
2500 PRINT 960,(FY(L),L=6,14),AD(5),BIAS(5)
2510 960 FORMAT("EXPO SMTH ",9(1X,F8.0),4X,F9.1,6X,F9.1)
2520 PRINT 970,(FYA(L),L=6,14),AD(6),BIAS(6)
2530 970 FORMAT("ADAPT SMTH",9(1X,F8.0),4X,F9.1,6X,F9.1)
2540 PRINT 980,(MS(J),J=1,9)
2550 980 FORMAT("METHOD SEL",3X,I2,8(9X,I1))
2560 PRINT 990,(FF(J),J=1,9),AD(7),BIAS(7)
2570 990 FORMAT("FOCUS FORC",9(1X,F8.0),4X,F9.1,6X,F9.1)
2580 PRINT 1000,(Q(I),I=1,20)
2590 1000 FORMAT(//,1X,"RAW QUARTERLY INPUT DATA"//,1X,10(F7.0,2X),
2600&/,1X,10(F7.0,2X),///)
2604 ICTR=ICTR+1
2605 198 CONTINUE
2610 STOP
2620 END
```

AD-A089 328 AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL--ETC F/G 5/1
MULTIPLE MODEL DEMAND FORECASTING COMPARED TO AIR FORCE LOGISTI--ETC(U)
JUN 80 T R GARLAND, H P MITCHELL
UNCLASSIFIED AFIT-LSSR-61-80 NL



APPENDIX H

DEMAND DATA FORECASTS

Actual and generated demand data forecasts are contained in this appendix. Actual demand data forecasts are listed first followed by generated demand data forecasts. Generated demand data forecasts are listed by normal, trend, seasonal, and cyclical demand data forecasts.

ACTUAL DEMAND DATA FORECASTS

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 1

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	9026.	8213.	9031.	8769.	9940.	10578.	10332.	8775.	8875.		
FORECAST	10327.	9847.	9047.	8925.	7700.	7908.	7949.	8932.	9483.	1240.5	-380.4
YL+Y(L+1)	6374.	7602.	6866.	9094.	9026.	8213.	9031.	8769.	9940.	1267.1	-958.2
SMITH #1	13973.	15883.	12045.	15621.	9328.	9884.	12340.	10670.	10307.	3235.9	2945.8
TREND	1327.	3270.	4366.	7559.	9876.	8258.	11823.	10498.	10801.	2893.5	-1751.4
EXPO SMTH	12311.	11369.	10468.	10193.	9960.	9611.	9495.	9350.	9468.	1366.0	965.0
ADAPT SMTH	10364.	8219.	9198.	8681.	8925.	9323.	9128.	9366.	9354.	682.6	-108.9
METHOD SEL	1	2	1	1	4	5	5	2	5		
FOCUS FORC	10327.	9847.	6866.	8925.	7700.	8258.	9468.	9468.	9940.	1382.0	-304.6

RAW QUARTERLY INPUT DATA

3531.	3577.	3093.	4078.	1344.	2712.	622.	1696.	2572.	1976.
2850.	1628.	1759.	2794.	2588.	2799.	2397.	2548.	1031.	2899.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 2

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	33.	28.	31.	17.	19.	15.	7.	14.	17.		
FORECAST	26.	26.	30.	35.	31.	30.	35.	27.	26.	11.7	9.2
YL+Y(L+1)	29.	31.	39.	37.	33.	28.	31.	17.	19.	10.1	9.2
SMITH #1	154.	151.	154.	29.	24.	35.	31.	12.	33.	49.6	49.1
TREND	35.	48.	44.	53.	33.	22.	20.	13.	2.	13.3	9.8
EXPO SMTH	30.	30.	32.	33.	33.	32.	32.	29.	27.	11.5	10.9
ADAPT SMTH	32.	35.	38.	48.	43.	43.	41.	41.	36.	19.8	19.6
METHOD SEL	4	5	5	3	3	4	4	4	2		
FOCUS FORC	35.	48.	27.	27.	24.	35.	20.	13.	2.	10.0	5.5

RAW QUARTERLY INPUT DATA

10.	1.	4.	8.	7.	1.	16.	5.	9.	9.
14.	1.	4.	12.	1.	3.	0.	4.	7.	6.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 3

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	2632.	2856.	3451.	3628.	3661.	3667.	3401.	3352.	3543.		
FORECAST	2055.	2228.	2208.	2274.	2365.	2550.	2799.	2988.	3147.	842.1	-842.1
YL+Y(L+1)	2098.	2243.	2146.	2347.	2432.	2856.	3451.	3628.	3661.	668.6	-569.9
SMITH #1	2242.	2992.	2902.	3958.	4246.	4025.	4474.	3667.	3465.	423.7	197.7
TREND	2085.	2417.	2271.	2514.	2816.	3769.	4862.	4730.	4085.	845.3	-71.4
EXPO SMTH	2165.	2180.	2173.	2208.	2293.	2406.	2615.	2817.	2986.	927.5	-927.5
ADAPT SMTH	2201.	2114.	2140.	2105.	2220.	2391.	2552.	2996.	3291.	909.2	-909.2
METHOD SEL	6	3	3	3	3	4	2	2	3		
FOCUS FORC	2012.	3291.	2902.	3958.	4246.	4025.	4862.	3628.	3661.	525.7	265.8

RAW QUARTERLY INPUT DATA

197.	547.	533.	535.	598.	604.	464.	432.	743.	507.
665.	717.	967.	1102.	842.	750.	973.	836.	793.	941.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 4

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	4033.	3857.	3199.	2688.	2663.	2742.	2571.	2445.	2143.		
FORECAST	3415.	3409.	3466.	3521.	3482.	3500.	3426.	3321.	3348.	742.1	505.1
YL+Y(L+1)	2930.	3143.	3653.	3954.	4033.	3857.	3199.	2688.	2663.	823.7	419.9
SMITH #1	3950.	4369.	4444.	3452.	2870.	2581.	2209.	2129.	2320.	425.1	220.3
TREND	2454.	2642.	3820.	4811.	4832.	4035.	2646.	2009.	1869.	1087.3	308.5
EXPO SMTH	3362.	3318.	3385.	3499.	3606.	3656.	3565.	3389.	3244.	789.2	520.5
ADAPT SMTH	3088.	2992.	3158.	3355.	3529.	3590.	3574.	3535.	3282.	829.2	417.9
METHOD SEL	3	1	5	6	3	3	4	2	3		
FOCUS FORC	3950.	4369.	3466.	3244.	3282.	2581.	2209.	2009.	2663.	390.6	159.1

RAW QUARTERLY INPUT DATA

902.	1047.	1023.	928.	676.	652.	832.	770.	889.	1162.
1133.	849.	713.	504.	622.	824.	792.	333.	496.	522.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 5

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	994.	953.	1117.	1223.	1508.	1691.	1891.	2055.	2017.		
FORECAST	908.	942.	937.	952.	992.	969.	1045.	1085.	1251.	485.6	-485.6
YL+Y(L+1)	990.	985.	972.	947.	994.	953.	1117.	1223.	1508.	424.9	-417.8
SMITH #1	1004.	1007.	966.	1155.	1329.	1483.	1974.	2074.	2499.	139.3	4.8
TREND	1032.	1102.	1004.	1030.	954.	976.	1266.	1546.	2100.	330.9	-271.8
EXPO SMTH	833.	864.	885.	898.	917.	924.	963.	1015.	1113.	559.7	-559.7
ADAPT SMTH	911.	958.	915.	916.	913.	931.	932.	998.	1108.	542.0	-541.0
METHOD SEL	2	1	4	3	3	3	3	3	4		
FOCUS FORC	990.	985.	937.	1030.	1329.	1483.	1974.	2074.	2499.	153.4	-16.3

RAW QUARTERLY INPUT DATA

205.	219.	224.	177.	278.	223.	278.	211.	273.	210.
253.	258.	232.	374.	359.	543.	415.	574.	523.	505.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 6

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	3595.	3098.	2976.	2943.	2471.	2515.	2601.	2444.	2691.		
FORECAST	3373.	3381.	3255.	3363.	3449.	3294.	3080.	3267.	3033.	511.3	462.0
YL+Y(L+1)	3302.	3490.	3183.	3590.	3595.	3098.	2976.	2943.	2471.	482..	368.2
SMITH #1	4263.	4278.	3427.	3830.	3072.	2307.	2556.	2835.	2312.	534.3	393.8
TREND	2926.	3739.	3470.	3591.	3767.	2893.	2531.	2374.	1826.	570.0	197.9
EXPO SMTH	3209.	3265.	3249.	3317.	3373.	3318.	3249.	3188.	3045.	516.?	431.0
ADAPT SMTH	3135.	3095.	3056.	3023.	3082.	3192.	3084.	3025.	2947.	363.6	234.0
METHOD SEL	6	6	6	6	6	3	3	4	2		
FOCUS FORC	3444.	2947.	2947.	2947.	2947.	2947.	2556.	2835.	1826.	282.?	6.9

RAW QUARTERLY INPUT DATA

1013.	924.	722.	785.	840.	979.	531.	952.	1028.	672.
938.	957.	531.	550.	905.	485.	575.	636.	748.	732.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 7

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	2418.	2316.	2043.	2089.	2252.	2380.	2281.	2133.	2073.		
FORECAST	2581.	2577.	2614.	2532.	2496.	2445.	2384.	2352.	2335.	258.8	258.8
YL+Y(L+1)	2574.	2574.	2724.	2614.	2416.	2316.	2043.	2089.	2252.	256.8	179.9
SMITH #1	2781.	2468.	2421.	1975.	1884.	2128.	2275.	2406.	2434.	251.9	87.6
TREND	2552.	1820.	2983.	3304.	2181.	1276.	1750.	2335.	2084.	522.6	33.3
EXPO SMTH	2056.	2159.	2272.	2341.	2356.	2348.	2287.	2247.	2248.	159.1	36.7
ADAPT SMTH	2449.	2606.	2706.	2586.	2485.	2456.	2397.	2307.	2237.	249.2	249.2
METHOD SEL	4	6	5	3	4	5	3	2	4		
FOCUS FORC	2552.	1820.	2237.	2248.	1884.	1276.	2248.	2406.	2252.	326.5	-117.8

RAW QUARTERLY INPUT DATA

489.	858.	814.	426.	482.	782.	759.	551.	482.	932.
649.	355.	380.	659.	695.	518.	508.	560.	547.	458.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 8

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	35.	29.	34.	49.	44.	58.	67.	63.	69.		
FORECAST	35.	37.	35.	38.	40.	39.	46.	52.	40.	11.8	-9.9
YL+Y(L+1)	44.	48.	57.	54.	35.	29.	34.	49.	44.	18.4	-6.0
SMITH #1	220.	54.	53.	33.	34.	32.	94.	117.	100.	43.8	32.1
TREND	59.	65.	89.	66.	38.	20.	29.	48.	39.	28.8	0.8
EXPO SMTH	14.	21.	28.	33.	34.	33.	33.	36.	38.	19.8	-19.8
ADAPT SMTH	17.	33.	38.	46.	50.	42.	38.	36.	40.	15.1	-12.1
METHOD SEL	1	1	6	2	6	6	1	1	2		
FOCUS FORC	35.	37.	35.	40.	35.	40.	40.	52.	40.	12.6	-10.7

RAW QUARTERLY INPUT DATA

9.	16.	1.	1.	7.	4.	9.	24.	11.	13.
6.	5.	5.	18.	21.	0.	19.	27.	17.	6.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 9

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	27.	21.	12.	10.	8.	4.	6.	9.	10.		
FORECAST	19.	23.	27.	25.	23.	24.	21.	17.	18.	11.7	9.8
YL+Y(L+1)	19.	26.	30.	24.	27.	21.	12.	10.	8.	10.0	7.8
SMITH #1	35.	59.	43.	30.	29.	7.	3.	2.	11.	14.6	12.3
TREND	27.	33.	36.	23.	25.	15.	3.	-4.	-10.	12.7	4.6
EXPO SMTH	29.	29.	29.	28.	28.	26.	23.	21.	18.	13.8	13.8
ADAPT SMTH	24.	22.	26.	28.	28.	29.	26.	22.	17.	13.1	12.5
METHOD SEL	6	1	6	4	1	3	4	2	3		
FOCUS FORC	18.	17.	27.	17.	25.	24.	3.	-4.	8.	10.0	3.0

RAW QUARTERLY INPUT DATA

1.	2.	6.	9.	3.	6.	8.	2.	10.	10.
2.	5.	4.	1.	1.	3.	0.	3.	3.	4.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 10

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	122.	86.	54.	75.	77.	98.	62.	37.	32.		
FORECAST	76.	91.	123.	124.	112.	109.	111.	117.	100.	45.6	35.4
YL+Y(L+1)	101.	132.	148.	159.	122.	86.	54.	75.	77.	45.9	36.8
SMITH #1	164.	144.	62.	35.	36.	50.	147.	144.	128.	58.4	29.9
TREND	159.	220.	297.	173.	97.	26.	57.	24.	-14.	74.1	44.0
EXPO SMTH	104.	109.	121.	129.	127.	119.	106.	100.	95.	44.9	40.8
ADAPT SMTH	103.	106.	124.	135.	127.	114.	99.	77.	80.	40.1	35.8
METHOD SEL	5	1	3	3	4	1	4	4	2		
FOCUS FORC	51.	95.	123.	35.	36.	26.	111.	24.	-14.	45.4	-17.3

RAW QUARTERLY INPUT DATA

14.	5.	2.	28.	15.	32.	14.	40.	46.	68.
5.	3.	10.	36.	26.	5.	31.	0.	1.	0.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 11

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	78.	43.	27.	39.	61.	71.	72.	74.	49.		
FORECAST	119.	124.	122.	117.	113.	94.	84.	75.	70.	44.7	44.7
YL+Y(L+1)	148.	143.	140.	109.	78.	44.	28.	39.	61.	54.2	30.7
SMITH #1	164.	68.	38.	10.	118.	117.	211.	224.	152.	71.8	65.3
TREND	165.	180.	191.	75.	-2.	-39.	-33.	-35.	40.	91.0	3.2
EXPO SMTH	99.	108.	114.	113.	106.	93.	80.	72.	70.	38.4	37.9
ADAPT SMTH	126.	145.	139.	138.	130.	111.	82.	62.	49.	54.7	52.0
METHOD SEL	5	3	3	3	2	1	1	1	4		
FOCUS FORC	90.	78.	38.	10.	118.	44.	84.	75.	70.	21.8	9.4

RAW QUARTERLY INPUT DATA

28.	35.	11.	16.	42.	35.	31.	40.	37.	32.
1.	9.	2.	16.	12.	31.	12.	17.	14.	6.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 12

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	881.	1081.	865.	729.	662.	679.	619.	680.	848.		
FORECAST	1050.	949.	976.	998.	950.	898.	879.	831.	772.	186.2	139.8
YL+Y(L+1)	1019.	715.	893.	933.	881.	1081.	865.	729.	662.	204.2	81.6
SMITH #1	1062.	811.	3044.	2645.	2505.	2603.	519.	498.	516.	992.0	795.3
TREND	860.	262.	784.	1049.	761.	988.	772.	817.	461.	258.6	-32.1
EXPO SMTH	1005.	947.	936.	935.	925.	956.	938.	896.	869.	178.9	149.1
ADAPT SMTH	1002.	980.	852.	946.	1019.	1078.	1129.	1071.	988.	249.8	224.4
METHOD SEL	4	5	2	6	4	1	3	2	5		
FOCUS FORC	860.	262.	849.	933.	988.	988.	879.	498.	662.	258.2	-13.9

RAW QUARTERLY INPUT DATA

242.	322.	278.	239.	344.	198.	282.	195.	40.	376.
322.	143.	240.	160.	186.	76.	257.	100.	247.	244.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 13

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	228.	21.	31.	70.	86.	66.	66.	31.	27.		
FORECAST	1069.	1041.	947.	786.	685.	470.	360.	267.	159.	572.8	572.8
YL+Y(L+1)	1140.	917.	685.	460.	229.	23.	33.	71.	86.	352.2	335.3
SMITH #1	630.	117.	0.	0.	0.	346.	385.	414.	377.	224.3	182.7
TREND	1011.	949.	148.	-266.	-741.	-535.	-567.	-414.	-198.	543.7	-137.6
EXPO SMTH	989.	974.	916.	825.	706.	569.	461.	383.	324.	613.4	613.4
ADAPT SMTH	1119.	1146.	927.	906.	759.	548.	337.	137.	87.	593.3	593.3
METHOD SEL	3	3	3	3	3	2	2	2	2		
FOCUS FORC	630.	117.	0.	0.	0.	346.	33.	71.	86.	121.9	73.1

RAW QUARTERLY INPUT DATA

285.	187.	322.	204.	451.	232.	225.	232.	228.	1.
1.	1.	21.	10.	39.	16.	1.	10.	4.	12.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 14

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	4436.	4233.	5339.	5499.	4835.	3713.	2730.	1683.	1920.		
FORECAST	4427.	4397.	4349.	4258.	4167.	3758.	4263.	4899.	4636.	1175.7	529.2
YL+Y(L+1)	3898.	3283.	3186.	4298.	4436.	4233.	5339.	5499.	4835.	1477.9	513.2
SMITH #1	6449.	6595.	6633.	10185.	7073.	5896.	5411.	2292.	1274.	2081.4	1937.7
TREND	2190.	3509.	1617.	3458.	3625.	5883.	7307.	7146.	4260.	2741.5	536.5
EXPO SMTH	4648.	4375.	4137.	4169.	4223.	4225.	4448.	4658.	4693.	1275.1	576.5
ADAPT SMTH	4520.	4054.	2965.	3086.	3366.	3543.	3636.	4071.	4658.	1413.5	-54.3
METHOD SEL	1	1	5	2	2	1	6	3	3		
FOCUS FORC	4427.	4397.	4349.	4693.	4436.	4233.	4263.	4658.	1274.	893.6	260.1

RAW QUARTERLY INPUT DATA

1428.	742.	1585.	1200.	1983.	743.	291.	881.	1368.	646.
1403.	1019.	1165.	1752.	1563.	355.	43.	769.	516.	592.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 15

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	3927.	4011.	5081.	5124.	4262.	4369.	3592.	2389.	2447.		
FORECAST	4001.	3945.	3689.	3753.	3908.	3960.	3990.	4288.	4095.	845.7	47.2
YL+Y(L+1)	3889.	3908.	2898.	3452.	3927.	4011.	5081.	5124.	4262.	1192.8	150.8
SMITH #1	4018.	4640.	3628.	9850.	9582.	8582.	9765.	3937.	2468.	2686.7	2363.7
TREND	3766.	3842.	1584.	2788.	4518.	4638.	6069.	6156.	4777.	1695.7	326.2
EXPO SMTH	4332.	4248.	3978.	3873.	3883.	3909.	4143.	4339.	4324.	912.7	203.0
ADAPT SMTH	4438.	4323.	4373.	3685.	3724.	3846.	3991.	4557.	4614.	973.9	260.9
METHOD SEL	2	1	6	6	4	4	6	3	3		
FOCUS FORC	3889.	3908.	3689.	4614.	4614.	4638.	6069.	4614.	2468.	820.8	366.6

RAW QUARTERLY INPUT DATA

1078.	773.	1115.	1147.	947.	1270.	690.	982.	966.	260.
1244.	1457.	1050.	1330.	1287.	595.	1157.	553.	84.	653.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 16

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	10.	22.	29.	33.	36.	27.	21.	14.	12.		
FORECAST	12.	9.	10.	11.	10.	16.	19.	22.	23.	12.8	-8.2
YL+Y(L+1)	9.	9.	9.	11.	10.	22.	29.	33.	36.	15.3	-4.0
SMITH #1	12.	12.	24.	33.	29.	87.	76.	69.	47.	27.9	22.6
TREND	0.	13.	11.	9.	8.	40.	54.	52.	41.	22.3	2.7
EXPO SMTH	13.	13.	12.	12.	11.	13.	17.	20.	23.	12.3	-7.8
ADAPT SMTH	11.	9.	8.	8.	9.	9.	11.	17.	21.	14.1	-11.2
METHOD SEL	2	5	3	3	3	2	1	5	6		
FOCUS FORC	9.	9.	23.	33.	29.	87.	29.	22.	23.	12.8	6.6

RAW QUARTERLY INPUT DATA

9.	0.	1.	4.	3.	3.	1.	2.	3.	3.
3.	1.	15.	10.	7.	4.	6.	4.	0.	2.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 17

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	130.	175.	162.	139.	146.	118.	111.	122.	105.		
FORECAST	173.	160.	134.	128.	131.	135.	130.	131.	138.	21.1	5.5
YL+Y(L+1)	131.	95.	97.	122.	130.	175.	162.	139.	146.	38.3	-1.2
SMITH #1	125.	101.	239.	246.	215.	269.	134.	120.	158.	62.1	44.2
TREND	28.	-49.	47.	137.	117.	224.	202.	164.	153.	84.3	-20.8
EXPO SMTH	119.	114.	111.	113.	116.	128.	135.	136.	138.	28.8	-10.9
ADAPT SMTH	144.	151.	124.	121.	123.	127.	138.	137.	131.	21.5	-1.3
METHOD SEL	2	1	6	4	1	5	6	3	5		
FOCUS FORC	131.	95.	134.	131.	117.	135.	138.	131.	158.	28.0	-4.2

RAW QUARTERLY INPUT DATA

40.	90.	59.	25.	51.	35.	23.	22.	15.	37.
48.	30.	40.	24.	25.	37.	32.	17.	36.	20.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 18

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	363.	276.	208.	136.	102.	110.	120.	372.	476.		
FORECAST	242.	264.	274.	282.	305.	288.	254.	234.	233.	137.9	23.3
YL+Y(L+1)	247.	299.	299.	331.	363.	276.	208.	136.	102.	172.2	10.9
SMITH #1	382.	480.	331.	301.	221.	59.	67.	61.	1710.	253.3	161.2
TREND	212.	350.	409.	427.	398.	227.	131.	-39.	-69.	233.0	-13.0
EXPO SMTH	197.	218.	234.	253.	275.	275.	262.	237.	210.	138.8	-0.2
ADAPT SMTH	233.	242.	234.	217.	247.	281.	270.	238.	194.	128.1	-0.8
METHOD SEL	3	1	5	5	6	3	4	6	6		
FOCUS FORC	382.	480.	274.	210.	210.	194.	67.	-39.	194.	144.4	-21.3

RAW QUARTERLY INPUT DATA

67.	69.	63.	39.	58.	88.	48.	53.	110.	88.
80.	85.	23.	20.	8.	51.	31.	30.	260.	155.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 19

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	10265.	10438.	10632.	10359.	10681.	10545.	9803.	8903.	9032.		
FORECAST	7263.	7331.	7066.	7661.	8674.	9304.	9862.	10153.	10473.	2041.3	-1430.3
YL+T(L+1)	7082.	8670.	9091.	9947.	10265.	10438.	10632.	10359.	10681.	1317.9	-443.7
SMITH 81	17603.	11700.	11681.	11704.	10799.	10945.	10846.	9715.	9263.	1511.0	1511.0
TREND	5009.	8658.	12941.	14602.	12582.	13077.	12587.	11062.	10535.	2718.7	1155.2
EXPO SMTH	3654.	4557.	5464.	6360.	7141.	7801.	8367.	8765.	9148.	3292.6	-3266.7
ADAPT SMTH	5375.	7082.	8170.	9091.	9916.	10283.	10223.	10374.	10235.	1788.5	-1101.1
METHOD SEL	1	3	3	2	3	2	1	5	3		
FOCUS FORC	7263.	7331.	11681.	11704.	10265.	10945.	10632.	10153.	9148.	1279.6	-170.5

RAW QUARTERLY INPUT DATA

2540.	3059.	1479.	366.	1587.	1609.	1813.	2073.	2675.	2530.
2669.	2391.	2848.	3724.	2396.	2713.	2712.	1982.	1496.	2842.

DIV CHK AT LOCATION 000361

DIV CHK AT LOCATION 000371

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 20

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	235.	196.	202.	200.	178.	215.	215.	249.	256.		
FORECAST	262.	219.	201.	210.	218.	191.	181.	197.	207.	29.1	-6.9
YL+T(L+1)	267.	185.	139.	194.	235.	196.	202.	200.	178.	34.4	-21.8
SMITH 81	236.	295.	244.	290.	242.	150.	457.	449.	471.	113.1	98.7
TREND	5.	103.	185.	150.	243.	149.	254.	205.	206.	72.9	-49.5
EXPO SMTH	243.	231.	217.	212.	217.	213.	210.	208.	202.	23.3	0.7
ADAPT SMTH	208.	172.	138.	109.	135.	170.	165.	157.	147.	60.6	-60.6
METHOD SEL	3	2	1	2	5	5	5	5	5		
FOCUS FORC	236.	295.	159.	210.	235.	202.	202.	202.	202.	37.3	-0.2

RAW QUARTERLY INPUT DATA

134.	93.	32.	64.	64.	82.	16.	39.	48.	56.
51.	80.	9.	62.	49.	58.	46.	62.	83.	65.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 21

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	121.	104.	4.	0.	11.	18.	18.	18.	7.		
FORECAST	191.	193.	227.	210.	204.	179.	147.	99.	68.	134.9	134.9
YL+T(L+1)	286.	253.	289.	196.	121.	104.	5.	2.	13.	114.0	107.6
SMITH 81	465.	176.	155.	3.	0.	0.	0.	11.	18.	70.6	58.6
TREND	441.	293.	389.	217.	4.	-124.	-194.	-160.	-89.	193.9	53.0
EXPO SMTH	141.	164.	189.	190.	176.	162.	130.	104.	84.	115.7	115.7
ADAPT SMTH	224.	286.	286.	286.	243.	210.	182.	129.	78.	180.4	180.4
METHOD SEL	5	5	3	3	4	3	2	3	2		
FOCUS FORC	95.	86.	86.	3.	0.	-124.	0.	2.	18.	36.3	-15.1

RAW QUARTERLY INPUT DATA

13.	32.	37.	13.	50.	64.	97.	75.	17.	100.
4.	1.	1.	1.	1.	11.	7.	0.	0.	0.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 22

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	2450.	2444.	1934.	1385.	886.	250.	423.	652.	1120.		
FORECAST	2256.	2228.	2222.	2181.	2140.	2208.	2023.	1804.	1668.	889.3	798.2
YL+Y(L+1)	1830.	1972.	2111.	2222.	2450.	2444.	1934.	1385.	886.	926.9	632.2
SMITH #1	1994.	2686.	2692.	2173.	1656.	826.	244.	219.	2772.	650.5	413.1
TREND	1270.	1743.	1907.	2116.	2795.	2975.	1573.	237.	-541.	1166.6	281.3
EXPO SMTH	2506.	2399.	2341.	2317.	2344.	2364.	2278.	2099.	1857.	1005.7	995.7
ADAPT SMTH	2139.	1831.	1964.	2140.	2308.	2505.	2499.	2491.	2046.	1136.3	931.0
METHOD SEL	6	5	4	6	3	3	3	4	2		
FOCUS FORC	2682.	2046.	1857.	2116.	2046.	826.	244.	219.	-541.	605.2	-5.3

RAW QUARTERLY INPUT DATA

698.	600.	646.	738.	500.	448.	453.	429.	642.	587.
564.	657.	636.	77.	15.	158.	0.	250.	244.	626.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 23

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	3312.	3221.	3100.	2693.	2493.	2258.	2054.	2241.	2467.		
FORECAST	3063.	3117.	3276.	3494.	3468.	3224.	3244.	3071.	2903.	636.2	557.5
YL+Y(L+1)	3624.	3226.	3387.	3448.	3312.	3221.	3100.	2693.	2493.	518.3	518.3
SMITH #1	3759.	3109.	3407.	3183.	2602.	2443.	2176.	1769.	2191.	279.9	88.9
TREND	4108.	4183.	4008.	3163.	2770.	3203.	2928.	1881.	1646.	712.6	450.2
EXPO SMTH	3464.	3416.	3410.	3418.	3397.	3361.	3309.	3186.	3047.	685.5	685.5
ADAPT SMTH	3503.	3442.	2978.	3046.	3118.	3152.	3162.	3143.	3070.	557.7	530.6
METHOD SEL	5	2	1	6	3	3	3	4	2		
FOCUS FORC	2501.	3047.	3387.	3494.	3070.	2443.	2176.	1769.	1646.	472.2	-33.8

RAW QUARTERLY INPUT DATA

723.	567.	395.	816.	1229.	724.	771.	900.	831.	885.
832.	764.	740.	764.	425.	564.	505.	560.	612.	790.

DIV CHK AT LOCATION 000361

DIV CHK AT LOCATION 000371

DIV CHK AT LOCATION 000361

DIV CHK AT LOCATION 000371

**THIS IS THE LAST TIME THE ABOVE MESSAG
FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 24

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1.	2.	3.	3.	5.	9.	8.	8.	5.		
FORECAST	0.	2.	3.	3.	4.	4.	4.	4.	5.	1.9	-1.9
YL+Y(L+1)	0.	2.	2.	2.	3.	4.	4.	3.	5.	2.1	-2.1
SMITH #1	0.	0.	0.	1.	2.	5.	9.	8.	8.	2.1	-1.2
TREND	2.	3.	3.	1.	4.	4.	4.	2.	9.	2.9	-1.5
EXPO SMTH	0.	0.	0.	0.	0.	1.	1.	1.	2.	4.3	-4.3
ADAPT SMTH	0.	0.	0.	0.	0.	0.	1.	2.	2.	4.3	-4.3
METHOD SEL	1	1	1	1	1	3	3	3	2		
FOCUS FORC	0.	2.	3.	3.	4.	4.	9.	8.	8.	1.3	-0.4

RAW QUARTERLY INPUT DATA

0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	3.	5.	0.	0.	0.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 25

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	40.	42.	38.	32.	23.	25.	30.	26.	20.		
FORECAST	27.	29.	31.	34.	37.	34.	30.	29.	32.	8.3	0.6
YL=Y(L+1)	34.	25.	22.	25.	40.	42.	38.	32.	23.	10.8	0.6
SMITH #1	12.	107.	113.	113.	118.	26.	20.	24.	18.	39.9	30.5
TREND	39.	28.	23.	14.	40.	49.	43.	33.	20.	12.2	1.4
EXPO SMTH	48.	43.	39.	36.	37.	38.	38.	37.	34.	8.1	8.1
ADAPT SMTH	48.	39.	29.	25.	24.	28.	31.	30.	28.	4.8	0.8
METHOD SEL	4	5	6	6	6	3	1	3	4		
FOCUS FORC	39.	28.	34.	28.	28.	28.	20.	29.	18.	5.2	-2.8

RAW QUARTERLY INPUT DATA

2.	4.	0.	13.	15.	11.	7.	1.	6.	8.
10.	16.	8.	4.	4.	7.	10.	9.	0.	1.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 26

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	46.	51.	46.	40.	34.	37.	33.	33.	23.		
FORECAST	33.	35.	36.	37.	46.	47.	40.	42.	40.	10.6	1.2
YL=Y(L+1)	45.	42.	33.	43.	46.	51.	46.	40.	34.	9.2	4.1
SMITH #1	125.	90.	100.	104.	42.	43.	28.	22.	26.	29.8	26.4
TREND	68.	42.	38.	52.	66.	51.	45.	24.	46.	15.7	9.8
EXPO SMTH	24.	28.	29.	32.	35.	38.	40.	40.	38.	11.1	-4.4
ADAPT SMTH	31.	33.	31.	18.	24.	34.	40.	42.	42.	13.1	-5.4
METHOD SEL	2	4	4	1	5	5	6	5	3		
FOCUS FORC	45.	42.	38.	52.	46.	38.	38.	42.	38.	8.1	4.0

RAW QUARTERLY INPUT DATA

1.	6.	11.	3.	7.	18.	3.	17.	4.	9.
13.	20.	9.	4.	7.	14.	12.	0.	7.	4.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 27

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	38.	38.	33.	23.	14.	14.	16.	26.	29.		
FORECAST	19.	20.	19.	26.	33.	29.	27.	27.	27.	11.2	-0.8
YL=Y(L+1)	26.	18.	19.	29.	39.	38.	33.	24.	15.	14.9	1.1
SMITH #1	60.	20.	20.	23.	14.	11.	11.	11.	27.	8.9	-4.0
TREND	28.	7.	31.	47.	57.	37.	32.	22.	17.	18.3	5.3
EXPO SMTH	11.	13.	14.	17.	21.	24.	26.	24.	23.	12.3	-6.2
ADAPT SMTH	21.	26.	22.	19.	21.	28.	27.	25.	22.	9.4	-2.1
METHOD SEL	4	6	4	3	3	3	3	5	3		
FOCUS FORC	28.	7.	22.	47.	14.	11.	11.	11.	23.	11.8	-6.5

RAW QUARTERLY INPUT DATA

0.	11.	1.	1.	8.	8.	5.	5.	1.	9.
14.	15.	1.	4.	4.	6.	0.	6.	14.	9.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 28

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	272.	217.	129.	133.	126.	150.	171.	127.	138.		
FORECAST	314.	261.	257.	243.	239.	226.	206.	212.	199.	76.9	76.9
YL+Y(L+1)	205.	235.	282.	291.	272.	217.	129.	133.	126.	74.3	47.4
SMITH #1	296.	288.	240.	165.	137.	104.	91.	245.	210.	62.7	34.8
TREND	-64.	179.	350.	346.	265.	172.	49.	39.	-3.	146.7	-14.5
EXPO SMTH	197.	204.	220.	234.	242.	237.	215.	199.	184.	71.6	52.1
ADAPT SMTH	199.	204.	211.	247.	257.	258.	250.	203.	195.	81.4	62.2
METHOD SEL	3	2	6	3	3	4	1	2	2		
FOCUS FORC	296.	288.	282.	195.	137.	104.	49.	212.	126.	65.0	25.1

RAW QUARTERLY INPUT DATA

190.	107.	78.	48.	53.	52.	42.	58.	83.	99.
51.	39.	28.	11.	55.	32.	52.	32.	11.	43.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 29

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1984.	1689.	1747.	1906.	1986.	2201.	2280.	2306.	2288.		
FORECAST	2547.	2524.	2429.	2325.	2244.	2104.	2012.	1972.	1985.	417.6	194.8
YL+Y(L+1)	2503.	2519.	2277.	2037.	1984.	1689.	1747.	1906.	1986.	417.7	29.0
SMITH #1	1980.	2044.	1598.	1630.	1969.	1813.	2328.	2522.	2436.	177.8	-7.6
TREND	2184.	2543.	2069.	1478.	1284.	1122.	1379.	1730.	1912.	604.2	-298.4
EXPO SMTH	2545.	2540.	2487.	2397.	2315.	2189.	2101.	2062.	2047.	405.3	255.1
ADAPT SMTH	2613.	2583.	2569.	2546.	2432.	2310.	2063.	1886.	1889.	508.5	278.4
METHOD SEL	3	3	3	2	2	1	6	5	3		
FOCUS FORC	1980.	2044.	1598.	1630.	1984.	1689.	2012.	1889.	2047.	247.1	-168.3

RAW QUARTERLY INPUT DATA

741.	631.	591.	628.	678.	683.	624.	518.	694.	441.
384.	465.	399.	499.	543.	545.	614.	578.	569.	527.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 30

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	262.	269.	265.	250.	259.	262.	265.	265.	262.		
FORECAST	170.	187.	202.	228.	242.	251.	252.	256.	261.	34.7	-34.7
YL+Y(L+1)	222.	233.	239.	261.	262.	269.	265.	250.	259.	15.7	-11.0
SMITH #1	308.	277.	277.	289.	254.	270.	261.	254.	275.	16.1	11.9
TREND	300.	306.	330.	346.	300.	288.	280.	261.	264.	35.8	34.9
EXPO SMTH	162.	177.	189.	203.	215.	226.	234.	237.	241.	52.7	-52.7
ADAPT SMTH	194.	220.	231.	235.	254.	258.	262.	261.	249.	21.6	-21.6
METHOD SEL	4	3	3	2	2	2	2	6	6		
FOCUS FORC	300.	306.	277.	289.	262.	269.	265.	250.	249.	18.1	12.0

RAW QUARTERLY INPUT DATA

25.	35.	26.	31.	48.	60.	55.	59.	59.	66.
77.	60.	66.	62.	62.	69.	69.	65.	62.	66.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 31

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	423.	395.	386.	281.	244.	261.	286.	329.	348.		
FORECAST	362.	319.	301.	351.	357.	384.	359.	346.	334.	70.3	17.5
YL+Y(L+1)	291.	373.	332.	410.	423.	395.	386.	281.	244.	100.2	20.2
SMITH #1	1243.	1340.	367.	456.	334.	267.	295.	236.	302.	244.7	209.8
TREND	164.	347.	379.	583.	594.	367.	310.	230.	155.	154.3	19.6
EXPO SMTH	304.	318.	321.	339.	355.	363.	368.	350.	329.	72.8	10.5
ADAPT SMTH	309.	329.	421.	406.	424.	439.	453.	457.	415.	117.8	77.7
METHOD SEL	1	2	4	5	3	3	3	1	5		
FOCUS FORC	362.	319.	332.	583.	329.	267.	295.	236.	334.	77.9	11.4

RAW QUARTERLY INPUT DATA

177.	107.	65.	83.	10.	111.	87.	83.	92.	70.
165.	96.	64.	41.	60.	59.	81.	86.	103.	78.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 32

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1066.	1043.	981.	914.	976.	1033.	1021.	1005.	906.		
FORECAST	1367.	1273.	1263.	1303.	1279.	1224.	1070.	1069.	1021.	213.5	213.5
YL+Y(L+1)	1491.	1405.	1159.	1223.	1066.	1043.	981.	914.	976.	175.0	145.9
SMITH #1	1449.	1120.	975.	1092.	806.	953.	956.	960.	1048.	127.4	45.9
TREND	1482.	1480.	1158.	1137.	772.	602.	650.	713.	996.	293.5	5.1
EXPO SMTH	1259.	1288.	1262.	1255.	1217.	1182.	1142.	1096.	1072.	203.1	203.1
ADAPT SMTH	1382.	1405.	1351.	1152.	1163.	1158.	1147.	1111.	1082.	222.7	222.7
METHOD SEL	5	3	3	3	2	2	2	3	2		
FOCUS FORC	1242.	1072.	975.	1092.	806.	1043.	981.	914.	1048.	93.7	25.4

RAW QUARTERLY INPUT DATA

444.	258.	268.	272.	342.	485.	283.	381.	256.	239.
347.	224.	233.	177.	280.	286.	290.	165.	244.	187.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 33

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	494.	453.	467.	312.	280.	236.	132.	128.	102.		
FORECAST	296.	344.	399.	487.	469.	437.	452.	432.	387.	205.3	122.8
YL+Y(L+1)	443.	421.	437.	551.	494.	453.	467.	312.	280.	164.4	139.3
SMITH #1	633.	552.	539.	663.	372.	349.	311.	87.	113.	121.9	112.7
TREND	760.	662.	544.	665.	560.	406.	411.	213.	133.	194.3	194.3
EXPO SMTH	457.	450.	448.	468.	473.	469.	469.	437.	406.	176.9	163.8
ADAPT SMTH	423.	443.	444.	468.	519.	496.	491.	491.	449.	203.2	180.1
METHOD SEL	5	5	5	6	3	3	3	3	3		
FOCUS FORC	149.	406.	406.	406.	449.	349.	311.	87.	113.	117.8	8.0

RAW QUARTERLY INPUT DATA

0.	0.	30.	119.	118.	94.	92.	139.	96.	110.
206.	82.	55.	124.	51.	50.	11.	20.	47.	24.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 34

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	51.	58.	43.	46.	50.	49.	44.	35.	28.		
FORECAST	44.	44.	54.	55.	54.	52.	48.	48.	51.	9.5	4.4
YL=Y(L+1)	56.	45.	52.	49.	51.	58.	43.	46.	50.	8.2	5.1
SMITH #1	47.	43.	76.	60.	67.	78.	44.	43.	33.	14.0	9.6
TREND	71.	58.	63.	43.	40.	56.	41.	46.	53.	10.9	7.4
EXPO SMTH	58.	55.	55.	53.	53.	54.	52.	51.	51.	9.2	8.6
ADAPT SMTH	61.	60.	51.	55.	58.	61.	65.	60.	55.	13.6	13.6
METHOD SEL	3	4	2	4	2	1	3	3	3		
FOCUS FORC	47.	43.	63.	49.	40.	58.	48.	43.	33.	8.7	2.1

RAW QUARTERLY INPUT DATA

8.	1.	8.	14.	19.	14.	13.	10.	8.	21.
10.	12.	15.	6.	13.	16.	14.	1.	4.	9.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 35

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	47.	51.	54.	46.	44.	41.	57.	52.	55.		
FORECAST	43.	42.	35.	41.	43.	46.	43.	46.	46.	8.3	-7.2
YL=Y(L+1)	38.	41.	31.	45.	47.	51.	54.	46.	44.	8.4	-5.6
SMITH #1	61.	65.	51.	91.	66.	66.	67.	72.	71.	18.8	18.1
TREND	28.	31.	26.	56.	62.	63.	53.	51.	49.	14.3	-3.1
EXPO SMTH	39.	39.	38.	39.	41.	43.	45.	45.	45.	8.4	-8.2
ADAPT SMTH	40.	41.	44.	40.	46.	51.	56.	63.	60.	6.8	-0.5
METHOD SEL	1	1	3	2	1	5	2	4	4		
FOCUS FORC	43.	42.	35.	91.	47.	46.	45.	46.	49.	12.2	-0.4

RAW QUARTERLY INPUT DATA

13.	17.	8.	10.	7.	13.	7.	11.	10.	3.
21.	13.	14.	6.	13.	11.	11.	22.	8.	14.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 36

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	735.	577.	529.	503.	401.	439.	315.	337.	371.		
FORECAST	1118.	986.	1098.	1029.	965.	800.	721.	689.	568.	418.4	418.4
YL=Y(L+1)	1194.	1023.	913.	875.	735.	577.	529.	503.	401.	282.6	282.6
SMITH #1	912.	641.	488.	475.	372.	282.	741.	680.	626.	168.8	112.2
TREND	1119.	1238.	833.	436.	280.	-13.	365.	126.	128.	276.9	34.8
EXPO SMTH	1202.	1167.	1114.	1068.	1001.	916.	839.	772.	698.	507.9	507.9
ADAPT SMTH	1182.	1138.	1027.	906.	979.	937.	804.	739.	656.	462.4	462.4
METHOD SEL	3	3	3	3	3	2	4	2	2		
FOCUS FORC	912.	641.	488.	475.	372.	282.	529.	126.	401.	105.6	2.2

RAW QUARTERLY INPUT DATA

450.	36.	263.	293.	357.	369.	163.	305.	186.	259.
125.	165.	28.	211.	99.	63.	66.	87.	121.	97.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 37

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1325.	1528.	1533.	1575.	1595.	1431.	1553.	1553.	1462.		
FORECAST	929.	1058.	1217.	1262.	1333.	1405.	1381.	1396.	1460.	235.1	-235.1
YL+Y(L+1)	1341.	1282.	1228.	1216.	1325.	1528.	1533.	1575.	1595.	163.1	-103.6
SMITH #1	1270.	1279.	1515.	1559.	1723.	1832.	1501.	1681.	1655.	137.5	51.1
TREND	2027.	1759.	1366.	1350.	1308.	1740.	1735.	1846.	1771.	300.7	149.7
EXPO SMTH	1108.	1143.	1160.	1171.	1202.	1267.	1320.	1371.	1416.	266.3	-266.3
ADAPT SMTH	1307.	1376.	1323.	1248.	1197.	1219.	1330.	1376.	1434.	194.0	-194.0
METHOD SEL	2	6	3	3	3	1	2	2	1		
FOCUS FORC	1341.	1282.	1434.	1559.	1723.	1832.	1381.	1575.	1595.	137.0	18.4

RAW QUARTERLY INPUT DATA

33.	4.	252.	228.	349.	377.	353.	262.	290.	323.
341.	371.	493.	328.	383.	391.	329.	450.	383.	300.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 38

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	87.	67.	44.	53.	64.	65.	76.	83.	83.		
FORECAST	113.	120.	117.	110.	93.	91.	81.	78.	76.	31.1	28.3
YL+Y(L+1)	99.	114.	118.	103.	87.	67.	44.	53.	64.	32.1	14.1
SMITH #1	102.	100.	61.	37.	41.	77.	74.	104.	116.	19.0	10.0
TREND	88.	97.	137.	72.	44.	22.	17.	19.	18.	43.9	-11.9
EXPO SMTH	136.	131.	129.	123.	116.	106.	94.	86.	81.	42.6	42.2
ADAPT SMTH	124.	111.	122.	123.	125.	116.	101.	83.	67.	42.5	38.9
METHOD SEL	4	4	3	3	4	2	3	1	6		
FOCUS FORC	88.	97.	137.	37.	41.	22.	44.	104.	76.	29.7	2.7

RAW QUARTERLY INPUT DATA

23.	42.	22.	40.	21.	32.	24.	22.	36.	36.
9.	6.	16.	13.	18.	17.	17.	24.	25.	17.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 39

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	6.	2.	0.	4.	4.	6.	6.	2.	2.		
FORECAST	0.	4.	6.	6.	5.	5.	5.	7.	7.	3.1	1.3
YL+Y(L+1)	0.	6.	8.	7.	6.	3.	2.	6.	6.	4.2	1.3
SMITH #1	0.	6.	2.	0.	0.	0.	4.	4.	2.	3.3	-1.6
TREND	2.	13.	14.	8.	5.	2.	0.	8.	2.	5.4	2.4
EXPO SMTH	0.	1.	2.	3.	3.	3.	2.	3.	3.	2.1	-1.3
ADAPT SMTH	0.	0.	0.	2.	2.	2.	2.	0.	1.	2.5	-2.5
METHOD SEL	4	1	6	1	4	1	1	6	3		
FOCUS FORC	2.	13.	6.	1.	5.	2.	5.	7.	1.	3.8	1.3

RAW QUARTERLY INPUT DATA

0.	0.	0.	1.	1.	1.	-1.	1.	4.	2.
1.	1.	1.	1.	4.	0.	2.	0.	0.	0.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 40

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	830.	900.	712.	690.	654.	629.	632.	558.	522.		
FORECAST	1089.	1037.	971.	956.	887.	855.	799.	750.	742.	228.6	228.6
YL+Y(L+1)	944.	909.	886.	809.	830.	800.	712.	690.	654.	134.1	134.1
SMITH #1	720.	818.	798.	666.	717.	633.	559.	623.	537.	50.9	4.7
TREND	723.	645.	702.	562.	723.	658.	478.	574.	553.	77.6	-45.3
EXPO SMTH	1220.	1157.	1103.	1044.	1001.	961.	911.	867.	824.	340.3	340.3
ADAPT SMTH	1102.	1003.	983.	963.	891.	851.	817.	744.	712.	226.5	226.5
METHOD SEL	4	3	4	3	3	3	3	4	3		
FOCUS FORC	723.	645.	798.	562.	717.	633.	559.	623.	553.	79.2	-23.7

RAW QUARTERLY INPUT DATA

312.	344.	229.	349.	243.	235.	275.	191.	208.	212.
198.	212.	178.	124.	176.	176.	153.	127.	102.	140.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 41

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	2040.	2127.	1940.	1944.	1812.	1760.	1919.	1961.	2003.		
FORECAST	2032.	1942.	1989.	1999.	2018.	2053.	1950.	1979.	1926.	102.4	42.3
YL+Y(L+1)	1995.	1979.	1960.	2014.	2040.	2127.	1940.	1944.	1812.	123.0	33.9
SMITH #1	2041.	2038.	2140.	2049.	2011.	1942.	1618.	1988.	1888.	135.4	23.1
TREND	1821.	2009.	2119.	1953.	2106.	2190.	1939.	1757.	1626.	205.4	1.6
EXPO SMTH	2030.	2020.	2008.	2009.	2015.	2038.	2018.	2003.	1965.	101.2	66.9
ADAPT SMTH	2049.	2036.	2046.	1986.	2014.	2031.	2054.	2027.	1998.	103.1	81.8
METHOD SEL	5	6	2	4	6	3	4	2	5		
FOCUS FORC	2048.	1965.	1998.	2014.	2106.	1998.	1618.	1757.	1812.	171.8	-18.8

RAW QUARTERLY INPUT DATA

647.	458.	450.	513.	484.	571.	416.	524.	468.	552.
470.	550.	555.	365.	474.	418.	503.	524.	516.	460.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 42

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	851.	868.	1133.	1255.	1663.	1341.	1189.	1337.	687.		
FORECAST	1747.	1628.	1636.	1345.	1272.	1415.	1480.	933.	1257.	442.1	265.2
YL+Y(L+1)	1691.	1961.	1827.	610.	851.	868.	1133.	1255.	1663.	630.1	170.6
SMITH #1	1794.	98394.	97755.	97019.	126785.	31105.	30996.	31077.	2743.	56394.0	56394.0
TREND	1654.	1982.	1042.	383.	255.	114.	390.	1529.	2090.	878.8	-98.3
EXPO SMTH	1599.	1671.	1702.	1484.	1357.	1259.	1234.	1238.	1323.	390.7	282.7
ADAPT SMTH	1218.	927.	974.	821.	571.	606.	647.	798.	902.	460.4	-318.0
METHOD SEL	6	6	4	1	5	5	2	2	6		
FOCUS FORC	1803.	902.	902.	383.	1272.	1323.	1323.	1255.	1663.	410.0	55.7

RAW QUARTERLY INPUT DATA

639.	193.	583.	388.	130.	343.	1218.	1.	400.	208.
1.	242.	417.	473.	123.	650.	95.	321.	271.	0.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 43

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1705.	1716.	1757.	1685.	1904.	2142.	2290.	2409.	2325.		
FORECAST	1873.	2004.	2002.	2034.	2107.	2065.	1782.	1591.	1805.	352.9	-74.8
YL+Y(L+1)	2508.	2413.	1807.	1496.	1705.	1716.	1757.	1685.	1904.	449.1	-104.7
SMITH 81	1702.	2047.	1630.	1752.	1992.	1871.	2139.	2124.	2733.	192.2	6.2
TREND	3093.	2453.	2066.	1287.	878.	738.	1629.	1498.	2212.	749.8	-208.9
EXPO SMTH	1915.	2014.	1973.	1878.	1843.	1818.	1805.	1781.	1806.	325.9	-122.2
ADAPT SMTH	2571.	2828.	2845.	2333.	2104.	1973.	1875.	1825.	1763.	627.1	242.7
METHOD SEL	3	5	2	3	5	6	3	3	4		
FOCUS FORC	1702.	2047.	1804.	1496.	1992.	1806.	1763.	2124.	2733.	244.8	-51.6

RAW QUARTERLY INPUT DATA

185.	419.	295.	339.	542.	1020.	670.	276.	447.	414.
359.	485.	458.	455.	287.	704.	696.	603.	406.	620.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 44

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	645.	605.	576.	501.	575.	601.	590.	607.	573.		
FORECAST	560.	579.	588.	624.	624.	619.	589.	573.	610.	42.8	10.0
YL+Y(L+1)	602.	632.	602.	644.	645.	605.	576.	581.	575.	48.3	12.1
SMITH 81	654.	688.	580.	610.	520.	548.	582.	532.	691.	57.1	14.7
TREND	644.	687.	692.	738.	644.	529.	515.	436.	582.	92.5	21.9
EXPO SMTH	571.	583.	587.	599.	608.	607.	601.	581.	580.	31.9	4.9
ADAPT SMTH	556.	554.	568.	584.	616.	624.	615.	601.	557.	38.8	0.2
METHOD SEL	4	1	3	6	6	2	1	5	2		
FOCUS FORC	644.	687.	588.	610.	557.	557.	576.	573.	588.	35.7	11.1

RAW QUARTERLY INPUT DATA

128.	136.	117.	136.	136.	184.	148.	134.	166.	154.
190.	135.	126.	125.	115.	209.	152.	114.	132.	175.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 45

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	386.	356.	449.	467.	461.	388.	255.	175.	122.		
FORECAST	556.	501.	468.	466.	365.	318.	347.	396.	424.	124.0	86.2
YL+Y(L+1)	341.	279.	245.	325.	386.	356.	449.	467.	461.	155.6	27.8
SMITH 81	96.	8453.	8720.	8872.	8867.	408.	390.	270.	205.	3770.0	3713.6
TREND	-159.	70.	115.	-39.	131.	400.	822.	675.	364.	369.2	-75.6
EXPO SMTH	810.	704.	612.	554.	521.	488.	480.	477.	474.	229.0	229.0
ADAPT SMTH	605.	341.	278.	275.	403.	510.	479.	493.	514.	190.0	93.2
METHOD SEL	2	2	1	1	2	4	1	3	3		
FOCUS FORC	341.	279.	245.	466.	365.	356.	822.	396.	205.	147.4	46.1

RAW QUARTERLY INPUT DATA

250.	171.	86.	264.	201.	140.	1.	1.	138.	105.
81.	62.	108.	198.	99.	56.	33.	63.	19.	3.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 46

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	7000.	6598.	7903.	7146.	7747.	7760.	6152.	5182.	4932.		
FORECAST	8850.	7565.	7533.	8304.	7236.	6240.	7374.	7583.	7374.	1382.2	848.6
YL+Y(L+1)	7472.	5881.	6845.	8020.	7000.	6598.	7903.	7146.	7747.	1284.4	465.8
SMITH #1	11106.	9837.	10682.	11074.	8065.	9089.	10763.	6332.	6385.	2545.8	2545.8
TREND	4219.	7079.	5053.	5727.	6045.	7719.	8340.	8062.	8396.	1978.5	24.5
EXPO SMTH	10973.	9954.	9332.	9070.	8656.	8244.	8176.	7970.	7925.	2209.1	2209.1
ADAPT SMTH	8587.	7053.	5557.	6829.	7244.	7306.	7308.	7619.	7681.	1333.8	529.4
METHOD SEL	2	4	1	2	3	4	6	3	3		
FOCUS FORC	7472.	5881.	5053.	8304.	7000.	9089.	8340.	7681.	6385.	1490.3	531.7

RAW QUARTERLY INPUT DATA

4243.	1483.	1188.	3313.	3265.	455.	1554.	2198.	1674.	1419.
2729.	1178.	1272.	2724.	1972.	1779.	1265.	1116.	1002.	1529.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 47

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	4177.	3905.	3999.	4050.	4175.	3864.	3659.	3283.	2964.		
FORECAST	4629.	4444.	4228.	4183.	3632.	3655.	3894.	4049.	4176.	479.7	312.4
YL+Y(L+1)	3086.	3405.	3788.	4047.	4177.	3905.	3999.	4050.	4175.	462.9	61.8
SMITH #1	3402.	4567.	4546.	4414.	4342.	3988.	3961.	3709.	3449.	427.8	255.6
TREND	1103.	2513.	2846.	2915.	4350.	4792.	4573.	4428.	3775.	1191.8	-309.0
EXPO SMTH	5931.	5425.	5098.	4888.	4746.	4578.	4462.	4379.	4339.	1085.4	1085.4
ADAPT SMTH	4318.	3099.	3256.	3784.	4134.	4463.	4382.	4315.	4265.	628.0	215.5
METHOD SEL	1	6	2	2	2	2	1	3	3		
FOCUS FORC	4629.	4444.	4265.	4047.	4177.	3905.	3999.	4049.	3449.	321.5	320.8

RAW QUARTERLY INPUT DATA

1668.	1420.	1122.	1962.	979.	605.	772.	730.	1298.	988.
1031.	860.	1026.	1082.	1082.	985.	715.	877.	706.	666.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 48

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	7461.	7616.	8581.	8867.	8552.	6941.	6617.	6313.	6181.		
FORECAST	6843.	7059.	6873.	6463.	6671.	7084.	7572.	7945.	8007.	1302.8	-290.7
YL+Y(L+1)	5880.	6552.	6562.	7022.	7461.	7616.	8581.	8867.	8552.	1684.9	-4.0
SMITH #1	7131.	8407.	7883.	9441.	9611.	8829.	8035.	6953.	6003.	841.8	573.9
TREND	4797.	6185.	5590.	7119.	8490.	9965.	10962.	9756.	8598.	2458.4	481.1
EXPO SMTH	6378.	6412.	6442.	6558.	6739.	6914.	7248.	7571.	7768.	1338.9	-566.5
ADAPT SMTH	5903.	5880.	6098.	6235.	6624.	6695.	7008.	7738.	8179.	1599.7	-752.2
METHOD SEL	3	1	3	3	4	1	6	3	3		
FOCUS FORC	7131.	8407.	6873.	9441.	9611.	9965.	7572.	8179.	6003.	1164.9	472.4

RAW QUARTERLY INPUT DATA

1778.	1838.	2501.	1688.	1538.	1456.	1221.	1665.	2210.	1466.
1681.	2194.	2365.	2431.	1967.	1789.	754.	2107.	1663.	1657.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 49

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	45950.	44301.	45328.	47112.	47058.	46815.	46060.	46849.	46530.		
FORECAST	36543.	38441.	40423.	42129.	44006.	44505.	45564.	46300.	46504.	3510.2	-3510.2
YL+Y(L+1)	42061.	44708.	45799.	45487.	45950.	44301.	45328.	47112.	47058.	1281.9	-911.0
SMITH #1	49183.	48297.	45837.	45309.	48461.	46245.	48310.	48379.	46873.	1737.5	1210.3
TREND	49655.	61387.	56618.	47488.	48755.	50215.	47034.	44205.	47386.	4669.8	4082.2
EXPO SMTH	37564.	38993.	40354.	41381.	42295.	42696.	43222.	44000.	44612.	4542.8	-4542.8
ADAPT SMTH	38101.	39317.	40712.	42165.	43174.	43929.	42914.	43460.	44511.	4191.1	-4191.1
METHOD SEL	3	2	2	4	2	3	1	2	1		
FOCUS FORC	49183.	48297.	45799.	45487.	48755.	44301.	48310.	46300.	47058.	1873.8	831.9

RAW QUARTERLY INPUT DATA

9626.	6399.	6242.	8757.	10775.	9272.	9967.	12047.	13422.	10363.
9655.	12510.	11773.	11390.	11439.	12456.	11530.	10635.	12228.	12137.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 50

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	116770.	121214.	135883.	146461.	163132.	165190.	189070.	184600.	177948.		
FORECAST	133454.	133653.	131532.	126887.	123052.	125495.	133752.	137679.	139951.	30340.1	-23868.4
YL+Y(L+1)	129333.	129775.	131620.	128896.	116770.	121214.	135883.	146461.	163132.	26603.6	-21909.3
SMITH #1	134732.	114040.	118707.	127415.	126958.	182006.	195528.	212965.	216504.	20858.5	3176.2
TREND	109313.	142633.	129490.	118131.	85615.	141840.	162084.	161034.	167091.	25097.1	-20337.3
EXPO SMTH	121995.	123551.	125164.	125911.	124083.	123509.	125984.	130079.	136690.	30936.2	-29255.9
ADAPT SMTH	123143.	121915.	112061.	114763.	115606.	114320.	111429.	116365.	124210.	40067.1	-38495.0
METHOD SEL	5	5	2	2	3	3	3	4	4		
FOCUS FORC	137575.	136690.	136690.	128896.	116770.	182006.	195528.	212965.	167091.	18167.7	1549.1

RAW QUARTERLY INPUT DATA

40435.	38858.	35478.	28804.	40390.	26771.	28913.	33259.	40832.	28616.
26189.	21133.	45276.	43285.	36767.	37804.	47334.	67165.	32297.	31152.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 51

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	3435.	3247.	3723.	3613.	3533.	3033.	2221.	1873.	2062.		
FORECAST	4624.	4747.	4546.	4574.	4081.	3958.	4204.	4184.	3484.	1295.6	1295.6
YL+Y(L+1)	4726.	4669.	4684.	4755.	3435.	3247.	3723.	3613.	3533.	1093.4	1071.7
SMITH #1	5119.	4027.	3955.	4608.	3057.	3528.	3490.	2231.	1998.	705.7	585.9
TREND	6041.	5492.	4290.	3253.	2863.	3091.	3119.	2167.	2713.	927.5	698.6
EXPO SMTH	5537.	5363.	5227.	5133.	4793.	4484.	4332.	4188.	4057.	1819.4	1819.4
ADAPT SMTH	4393.	4347.	4533.	5149.	5519.	4945.	4521.	4291.	4069.	1669.7	1669.7
METHOD SEL	1	3	3	4	2	4	4	4	3		
FOCUS FORC	4624.	4747.	3955.	4608.	2863.	3247.	3119.	2167.	2713.	737.9	589.0

RAW QUARTERLY INPUT DATA

902.	1143.	879.	1598.	1204.	727.	864.	1931.	1147.	742.
935.	611.	959.	1218.	825.	531.	459.	406.	477.	720.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 52

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	350.	374.	353.	323.	343.	297.	351.	299.	263.		
FORECAST	474.	467.	411.	407.	368.	383.	337.	340.	347.	67.6	64.3
YL+Y(L+1)	386.	392.	320.	356.	350.	374.	353.	323.	343.	34.4	27.1
SMITH #1	308.	366.	300.	342.	301.	401.	352.	462.	455.	69.2	37.0
TREND	101.	212.	219.	304.	210.	381.	347.	352.	237.	97.3	-56.8
EXPO SMTH	467.	452.	426.	412.	399.	394.	386.	373.	367.	80.6	80.6
ADAPT SMTH	487.	444.	440.	399.	395.	406.	415.	427.	421.	97.7	97.7
METHOD SEL	2	3	2	3	2	2	3	2	4		
FOCUS FORC	386.	392.	300.	356.	301.	374.	353.	462.	343.	56.0	34.9

RAW QUARTERLY INPUT DATA

133.	180.	125.	124.	113.	139.	82.	52.	119.	67.
118.	46.	143.	46.	88.	66.	97.	100.	36.	30.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 53

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1527.	1512.	1524.	1511.	1716.	1630.	1541.	1552.	1524.		
FORECAST	1743.	1665.	1634.	1561.	1470.	1491.	1534.	1611.	1622.	119.7	32.3
YL+Y(L+1)	1412.	1469.	1543.	1711.	1527.	1512.	1524.	1511.	1716.	103.8	-12.4
SMITH #1	1719.	1554.	1563.	1671.	1304.	1988.	1928.	1795.	2013.	258.2	166.5
TREND	835.	1139.	1237.	1995.	1402.	1542.	1585.	1774.	1640.	291.1	-98.9
EXPO SMTH	1430.	1438.	1459.	1509.	1513.	1513.	1515.	1514.	1554.	72.6	-65.9
ADAPT SMTH	1408.	1394.	1381.	1440.	1586.	1451.	1358.	1257.	1138.	180.3	-180.3
METHOD SEL	5	3	2	1	2	6	1	5	5		
*FOCUS FORC	2073.	1554.	1563.	1711.	1470.	1512.	1138.	1611.	1554.	187.2	16.7

RAW QUARTERLY INPUT DATA

587.	472.	454.	360.	375.	335.	340.	362.	432.	409.
508.	178.	417.	421.	495.	383.	331.	332.	506.	355.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 54

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	311.	326.	287.	329.	342.	397.	465.	537.	550.		
FORECAST	714.	657.	555.	480.	427.	417.	352.	346.	327.	198.3	81.8
YL+Y(L+1)	542.	508.	416.	363.	311.	326.	287.	329.	342.	141.3	-13.3
SMITH #1	333.	301.	282.	261.	319.	376.	348.	589.	614.	44.2	-13.5
TREND	314.	71.	126.	118.	175.	134.	135.	263.	392.	202.3	-201.7
EXPO SMTH	672.	639.	594.	548.	501.	466.	430.	410.	396.	193.8	123.6
ADAPT SMTH	650.	622.	634.	553.	453.	373.	340.	306.	327.	213.3	79.3
METHOD SEL	4	3	3	2	3	1	5	3	3		
FOCUS FORC	314.	71.	282.	261.	311.	376.	352.	396.	614.	78.0	-63.1

RAW QUARTERLY INPUT DATA

187.	288.	219.	191.	108.	176.	122.	136.	74.	84.
69.	84.	89.	45.	111.	97.	144.	113.	183.	110.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 55

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	221.	215.	268.	261.	272.	297.	250.	271.	253.		
FORECAST	183.	170.	177.	183.	206.	186.	222.	221.	247.	57.4	-57.4
YL+Y(L+1)	190.	157.	175.	180.	221.	215.	268.	261.	272.	49.2	-41.0
SMITH 81	211.	225.	250.	275.	294.	237.	348.	292.	387.	43.2	23.4
TREND	113.	210.	220.	152.	215.	285.	401.	280.	336.	64.6	-10.8
EXPO SMTH	169.	167.	168.	171.	181.	188.	204.	215.	227.	68.7	-68.7
ADAPT SMTH	189.	187.	134.	140.	144.	161.	176.	219.	222.	81.8	-81.8
METHOD SEL	3	4	3	3	3	4	2	4	1		
FOCUS FORC	211.	225.	220.	275.	294.	237.	401.	261.	336.	45.4	16.8

RAW QUARTERLY INPUT DATA

81.	37.	22.	35.	88.	33.	30.	39.	55.	51.
35.	80.	49.	104.	28.	91.	74.	57.	49.	73.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 56

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	596.	337.	157.	39.	1.	1.	1.	1.	52.		
FORECAST	887.	832.	877.	819.	773.	670.	576.	404.	300.	550.2	550.2
YL+Y(L+1)	950.	1003.	995.	767.	596.	337.	157.	40.	1.	417.9	407.0
SMITH 81	972.	687.	451.	120.	48.	0.	0.	0.	0.	133.7	121.5
TREND	916.	1314.	1000.	779.	211.	-246.	-621.	-561.	-583.	573.0	113.8
EXPO SMTH	687.	756.	799.	793.	753.	670.	567.	462.	370.	518.5	518.5
ADAPT SMTH	798.	886.	914.	933.	854.	796.	637.	452.	264.	594.4	594.4
METHOD SEL	5	5	3	3	3	3	3	3	2		
FOCUS FORC	824.	370.	370.	120.	48.	0.	0.	0.	0.	72.9	60.7

RAW QUARTERLY INPUT DATA

369.	90.	235.	130.	206.	188.	346.	210.	259.	180.
118.	39.	1.	1.	1.	1.	0.	0.	0.	52.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 57

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	403.	414.	387.	373.	408.	449.	460.	479.	374.		
FORECAST	480.	433.	432.	438.	433.	432.	405.	388.	406.	47.2	10.8
YL+Y(L+1)	462.	450.	422.	403.	403.	414.	387.	373.	408.	45.9	-2.8
SMITH 81	386.	379.	384.	361.	364.	394.	385.	430.	510.	47.3	-17.2
TREND	493.	426.	323.	345.	493.	339.	225.	325.	577.	106.7	-20.2
EXPO SMTH	514.	502.	486.	469.	456.	448.	435.	423.	420.	63.3	45.1
ADAPT SMTH	449.	426.	455.	441.	431.	422.	425.	423.	418.	42.2	15.9
METHOD SEL	3	4	3	4	2	5	5	5	1		
FOCUS FORC	386.	379.	323.	361.	493.	414.	420.	420.	420.	43.7	-14.5

RAW QUARTERLY INPUT DATA

156.	87.	111.	143.	75.	113.	141.	133.	63.	85.
122.	133.	74.	58.	108.	168.	115.	69.	127.	63.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 58

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	10396.	9594.	10847.	10346.	9920.	11427.	10954.	10403.	10867.		
FORECAST	12353.	11681.	10799.	10695.	10809.	10119.	10445.	10460.	10158.	879.2	307.1
YL+T(L+1)	11221.	10643.	10043.	10574.	10396.	9594.	10847.	10346.	9920.	702.9	-130.0
SMITH #1	11247.	9987.	9297.	12947.	11720.	10787.	14765.	11415.	10940.	1414.5	927.9
TREND	8307.	9546.	7383.	9982.	10198.	9610.	9955.	10175.	10434.	1080.1	-1018.2
EXPO SMTH	10747.	10726.	10589.	10586.	10548.	10357.	10455.	10433.	10331.	527.1	2.2
ADAPT SMTH	10538.	10307.	9466.	9331.	9132.	9142.	8833.	9077.	9402.	1248.7	-1058.5
METHOD SEL	5	4	1	2	4	3	2	5	3		
FOCUS FORC	13485.	10331.	7383.	10695.	10396.	9610.	14765.	10346.	10331.	1592.9	287.5

RAW QUARTERLY INPUT DATA

4095.	3411.	3382.	2597.	3328.	2248.	2643.	3002.	2750.	1648.
3174.	2824.	1948.	2901.	2673.	2398.	3455.	2428.	2122.	2862.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 59

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	7021.	7404.	6527.	5897.	6276.	6196.	6183.	5721.	6001.		
FORECAST	6715.	6564.	6558.	7207.	7005.	6951.	6736.	6679.	6649.	680.8	426.1
YL+T(L+1)	6988.	6497.	6945.	7460.	7021.	7404.	6527.	5897.	6276.	629.9	421.0
SMITH #1	7629.	6767.	8206.	7179.	5883.	7092.	5590.	5960.	6235.	729.0	368.2
TREND	7148.	6243.	7961.	8466.	7138.	7251.	5381.	5729.	6024.	893.4	457.1
EXPO SMTH	6946.	6656.	6874.	6991.	6997.	7079.	6968.	6754.	6658.	682.6	544.2
ADAPT SMTH	6832.	6815.	6583.	6755.	6910.	6766.	6743.	6520.	6206.	495.4	322.5
METHOD SEL	2	5	1	6	3	6	2	4	4		
FOCUS FORC	6988.	6497.	6658.	7207.	6206.	7092.	6206.	5897.	6024.	396.6	172.1

RAW QUARTERLY INPUT DATA

1646.	2024.	1040.	1732.	1835.	1563.	1823.	1767.	1344.	2011.
2338.	1328.	1727.	1134.	1708.	1707.	1647.	1121.	1246.	1987.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 60

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1910.	1763.	1693.	1844.	1679.	1901.	2048.	1889.	1919.		
FORECAST	1706.	1824.	1867.	1659.	1789.	1796.	1673.	1696.	1795.	170.2	-93.7
YL+T(L+1)	1667.	1829.	1653.	1547.	1910.	1763.	1693.	1844.	1679.	183.9	-117.9
SMITH #1	1647.	2644.	2048.	2038.	2632.	1656.	1925.	2456.	1993.	406.1	265.8
TREND	1815.	1502.	987.	1874.	2141.	1520.	1403.	2246.	1846.	334.5	-145.8
EXPO SMTH	1487.	1555.	1575.	1569.	1637.	1662.	1669.	1704.	1699.	232.2	-232.2
ADAPT SMTH	1767.	1715.	1754.	1540.	1327.	1486.	1515.	1525.	1558.	286.6	-273.0
METHOD SEL	4	6	6	4	1	1	3	2	4		
FOCUS FORC	1815.	1502.	1558.	1558.	2141.	1796.	1673.	2456.	1679.	280.8	-52.1

RAW QUARTERLY INPUT DATA

229.	297.	888.	331.	303.	558.	578.	228.	465.	382.
472.	591.	318.	312.	623.	426.	540.	459.	464.	456.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 61

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	475.	667.	649.	506.	475.	583.	578.	624.	616.		
FORECAST	632.	644.	614.	650.	652.	619.	610.	576.	575.	64.3	21.9
YL+Y(L+1)	628.	571.	570.	646.	675.	667.	649.	506.	475.	108.4	1.6
SMITH #1	614.	614.	651.	701.	565.	507.	623.	504.	640.	74.0	5.2
TREND	616.	420.	510.	723.	719.	648.	597.	451.	400.	153.2	-32.2
EXPO SMTH	644.	630.	618.	623.	634.	640.	642.	615.	587.	59.4	28.9
ADAPT SMTH	652.	644.	600.	595.	618.	637.	652.	655.	613.	54.4	32.6
METHOD SEL	6	6	3	6	3	6	4	5	5		
FOCUS FORC	636.	613.	613.	701.	613.	507.	613.	451.	587.	86.1	-4.2

RAW QUARTERLY INPUT DATA

102.	214.	160.	160.	183.	154.	157.	134.	126.	153.
233.	163.	118.	135.	90.	132.	226.	130.	136.	124.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 62

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	993.	1083.	1102.	1031.	1000.	961.	903.	920.	858.		
FORECAST	862.	829.	855.	878.	894.	939.	956.	969.	997.	128.3	-75.1
YL+Y(L+1)	794.	795.	809.	906.	993.	1083.	1102.	1031.	1000.	165.1	-37.6
SMITH #1	865.	1004.	1123.	1231.	1142.	1106.	985.	846.	908.	102.2	39.9
TREND	674.	755.	793.	973.	1170.	1300.	1338.	1120.	1022.	258.1	32.7
EXPO SMTH	909.	886.	871.	878.	901.	937.	970.	982.	986.	116.1	-58.8
ADAPT SMTH	887.	842.	843.	843.	857.	902.	970.	1006.	1009.	144.4	-76.8
METHOD SEL	5	3	3	4	2	1	6	1	3		
FOCUS FORC	929.	986.	1123.	1231.	1170.	1083.	956.	1009.	997.	106.0	70.2

RAW QUARTERLY INPUT DATA

269.	187.	228.	245.	202.	225.	177.	190.	203.	239.
274.	277.	293.	258.	203.	246.	254.	200.	220.	184.

FORECASTS BASED UPON IDENTICAL DEMAND DATA — ITEM # 63

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	148.	137.	146.	113.	87.	61.	56.	70.	84.		
FORECAST	165.	183.	177.	173.	173.	165.	150.	126.	118.	58.4	58.4
YL+Y(L+1)	198.	193.	153.	139.	148.	137.	146.	113.	87.	45.8	45.8
SMITH #1	132.	152.	113.	167.	157.	109.	101.	41.	49.	38.4	13.1
TREND	255.	195.	93.	132.	102.	88.	88.	87.	29.	42.5	18.5
EXPO SMTH	171.	175.	171.	164.	161.	156.	154.	146.	134.	58.9	58.9
ADAPT SMTH	206.	198.	183.	158.	132.	142.	145.	148.	142.	61.4	61.4
METHOD SEL	5	3	2	4	4	4	4	4	2		
FOCUS FORC	132.	134.	113.	139.	102.	88.	88.	87.	29.	24.9	1.1

RAW QUARTERLY INPUT DATA

9.	30.	57.	34.	49.	58.	63.	28.	44.	18.
49.	37.	33.	27.	16.	11.	7.	22.	38.	25.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 64

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1998.	2059.	2229.	2380.	2279.	2347.	2605.	2447.	2397.		
FORECAST	797.	877.	908.	1063.	1176.	1366.	1758.	2100.	2139.	951.0	-951.0
YL+T(L+1)	352.	673.	1287.	1820.	1998.	2059.	2229.	2380.	2279.	629.3	-629.3
SMITH #1	74462.	75346.	75758.	3406.	2635.	2358.	2551.	2786.	2528.	24577.4	24565.4
TREND	-26.	198.	1880.	3182.	3376.	2987.	3390.	3635.	2493.	982.2	41.4
EXPO SMTH	524.	554.	700.	924.	1139.	1323.	1504.	1679.	1799.	1177.1	-1177.1
ADAPT SMTH	303.	239.	434.	906.	1411.	1729.	1947.	2001.	2062.	1078.8	-1078.8
METHOD SEL	1	1	4	2	2	3	3	2	4		
FOCUS FORC	797.	877.	908.	3182.	1998.	2059.	2551.	2786.	2279.	620.7	-367.3

RAW QUARTERLY INPUT DATA

161.	554.	342.	184.	1.	1.	119.	233.	320.	615.
652.	411.	381.	785.	803.	310.	449.	1043.	645.	260.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 65

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	189.	205.	253.	229.	283.	248.	243.	234.	179.		
FORECAST	136.	141.	138.	149.	144.	169.	187.	207.	236.	74.7	-62.0
YL+T(L+1)	98.	133.	120.	184.	189.	205.	253.	229.	283.	66.3	-41.0
SMITH #1	342.	399.	323.	497.	309.	453.	454.	319.	367.	155.7	155.7
TREND	35.	120.	120.	244.	224.	288.	389.	312.	329.	95.5	-0.3
EXPO SMTH	135.	134.	131.	142.	151.	162.	180.	190.	209.	76.4	-69.9
ADAPT SMTH	141.	132.	155.	155.	169.	185.	188.	198.	201.	64.5	-59.7
METHOD SEL	6	6	3	4	3	4	2	2	5		
FOCUS FORC	174.	201.	201.	497.	224.	453.	389.	229.	283.	95.4	65.3

RAW QUARTERLY INPUT DATA

47.	39.	49.	39.	22.	45.	8.	23.	57.	32.
72.	28.	73.	80.	48.	82.	38.	75.	39.	27.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 66

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	2811.	3961.	5914.	6605.	7913.	8460.	8139.	9201.	9842.		
FORECAST	130.	407.	749.	1143.	1537.	2386.	3704.	4443.	5362.	4776.3	-4776.3
YL+T(L+1)	260.	811.	1494.	2281.	2811.	3961.	5914.	6605.	7913.	3421.8	-3421.8
SMITH #1	204880.	207781.	209349.	211703.	8306.	11150.	12519.	10790.	12901.	91835.8	91835.8
TREND	652.	1876.	3121.	4236.	4907.	7400.	11268.	10734.	11440.	2192.4	-801.1
EXPO SMTH	52.	203.	461.	825.	1222.	1770.	2599.	3400.	4303.	5334.4	-5334.4
ADAPT SMTH	0.	0.	549.	1233.	2021.	2811.	3961.	5914.	6605.	4416.9	-4416.9
METHOD SEL	4	4	4	4	3	4	2	4	4		
FOCUS FORC	652.	1876.	3121.	4236.	4907.	11150.	11268.	6605.	11440.	2491.6	-843.4

RAW QUARTERLY INPUT DATA

0.	0.	0.	1.	1.	1.	1.	260.	549.	684.
788.	790.	1699.	2637.	1429.	2098.	2246.	2316.	2541.	2739.

FORECASTS BASED UPON IDENTICAL DEMAND DATA ITEM # 67

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	125192.	117680.	107967.	112039.	109550.	168607.	366259.	377969.	366399.		
FORECAST	133371.	130684.	134785.	131621.	125257.	115841.	113544.	119425.	117371.	99593.6	-81085.1
YL+T(L+1)	125321.	114001.	119120.	126811.	125192.	117680.	107967.	112039.	109550.	97485.9	-88220.1
SMITH #1	117795.	116078.	120585.	116959.	109369.	101521.	181167.	432600.	434784.	44656.7	-13422.6
TREND	108794.	99643.	109133.	108901.	108477.	102137.	110693.	115877.	100157.	98909.0	-98649.8
EXPO SMTH	147993.	141195.	136780.	134786.	132867.	129830.	125457.	122774.	120129.	100248.7	-73316.8
ADAPT SMTH	137456.	126183.	114639.	113977.	122989.	125218.	126429.	123080.	123039.	91487.2	-82172.6
METHOD SEL	2	3	4	6	3	5	3	3	3		
FOCUS FORC	125321.	114001.	120585.	108901.	123039.	101521.	120129.	432600.	434784.	52142.6	-18975.8

RAW QUARTERLY INPUT DATA

34280.	30262.	37106.	39773.	40226.	33344.	23087.	28864.	28906.	38463.
30778.	27045.	21394.	28750.	34850.	24556.	80451.	226402.	46560.	12986.

NORMAL DEMAND DATA FORECASTS

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	472.	355.	350.	510.	551.	564.	585.	435.	468.		
FORECAST	419.	444.	438.	417.	407.	421.	408.	495.	512.	99.1	-36.8
YL=Y(L+1)	341.	486.	465.	480.	472.	355.	350.	510.	551.	120.9	-31.1
SMITH B1	770.	903.	386.	405.	557.	502.	596.	796.	575.	170.3	133.4
TREND	184.	508.	628.	516.	430.	278.	432.	637.	538.	173.0	-15.6
EXPO SMTH	370.	393.	408.	422.	432.	417.	403.	425.	450.	84.7	-63.3
ADAPT SMTH	407.	409.	487.	465.	479.	491.	463.	444.	465.	64.5	-19.8
METHOD SEL	1	5	3	4	3	3	3	6	6		
FOCUS FORC	419.	444.	450.	405.	430.	502.	596.	796.	465.	100.4	24.1

RAW QUARTERLY INPUT DATA

149.	143.	108.	97.	53.	153.	51.	84.	198.	132.
66.	76.	81.	127.	226.	117.	94.	148.	76.	150.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	504.	416.	412.	533.	565.	575.	591.	478.	502.		
FORECAST	465.	484.	479.	463.	455.	466.	456.	522.	535.	74.9	-28.1
YL=Y(L+1)	406.	515.	500.	511.	504.	416.	412.	533.	565.	91.6	-23.8
SMITH B1	622.	724.	429.	445.	554.	513.	587.	736.	569.	103.6	67.1
TREND	288.	530.	622.	539.	473.	357.	473.	629.	557.	131.2	-12.1
EXPO SMTH	427.	445.	456.	467.	474.	463.	452.	469.	488.	64.6	-48.5
ADAPT SMTH	455.	457.	515.	499.	509.	518.	496.	482.	498.	49.4	-16.5
METHOD SEL	1	5	3	4	3	3	3	6	6		
FOCUS FORC	465.	484.	488.	445.	473.	513.	587.	736.	498.	76.7	12.4

RAW QUARTERLY INPUT DATA

149.	146.	119.	110.	77.	152.	76.	101.	186.	137.
87.	94.	98.	133.	208.	126.	108.	149.	95.	150.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	910.	864.	862.	925.	942.	947.	956.	897.	909.		
FORECAST	890.	899.	897.	888.	884.	890.	885.	919.	926.	39.2	-15.1
YL=Y(L+1)	858.	915.	907.	913.	910.	864.	862.	925.	942.	47.8	-12.9
SMITH B1	921.	979.	862.	873.	927.	902.	947.	1022.	925.	43.2	16.3
TREND	794.	922.	971.	927.	894.	834.	895.	975.	938.	68.3	-6.9
EXPO SMTH	869.	878.	884.	890.	894.	888.	883.	891.	901.	34.0	-25.9
ADAPT SMTH	884.	885.	915.	906.	912.	917.	906.	898.	906.	25.9	-9.3
METHOD SEL	3	5	3	4	3	6	3	6	6		
FOCUS FORC	921.	979.	901.	873.	894.	902.	906.	1022.	906.	54.3	10.3

RAW QUARTERLY INPUT DATA

240.	238.	224.	219.	202.	241.	201.	214.	259.	233.
207.	211.	213.	231.	270.	229.	218.	240.	211.	240.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	828.	792.	791.	840.	853.	856.	862.	816.	824.		
FORECAST	811.	819.	818.	812.	809.	813.	809.	836.	841.	30.4	-10.9
YL+Y(L+1)	789.	834.	827.	831.	828.	792.	791.	840.	853.	37.4	-8.8
SMITH #1	837.	881.	789.	798.	841.	821.	856.	913.	837.	33.6	12.1
TREND	744.	844.	879.	843.	815.	768.	815.	878.	849.	53.9	-3.4
EXPO SMTH	796.	803.	808.	813.	816.	811.	807.	814.	821.	25.8	-19.4
ADAPT SMTH	808.	809.	832.	825.	829.	832.	824.	818.	824.	20.4	-7.0
METHOD SEL	3	5	3	4	3	6	3	6	6		
FOCUS FORC	837.	881.	821.	798.	815.	821.	824.	913.	824.	42.3	7.8

RAW QUARTERLY INPUT DATA

216.	214.	203.	200.	187.	218.	187.	197.	232.	211.
191.	194.	196.	210.	240.	207.	199.	216.	194.	217.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1027.	1017.	1017.	1031.	1035.	1036.	1037.	1024.	1026.		
FORECAST	1023.	1025.	1025.	1023.	1022.	1023.	1022.	1030.	1031.	8.9	-3.2
YL+Y(L+1)	1016.	1029.	1027.	1028.	1027.	1017.	1017.	1031.	1035.	11.0	-2.6
SMITH #1	1028.	1041.	1015.	1018.	1030.	1025.	1036.	1051.	1029.	9.4	2.5
TREND	1003.	1031.	1041.	1031.	1023.	1010.	1025.	1042.	1034.	15.3	-1.0
EXPO SMTH	1018.	1021.	1022.	1023.	1024.	1022.	1021.	1023.	1026.	7.4	-5.5
ADAPT SMTH	1022.	1022.	1029.	1027.	1028.	1029.	1027.	1025.	1027.	5.8	-1.6
METHOD SEL	3	5	3	4	3	6	3	6	6		
FOCUS FORC	1028.	1041.	1026.	1018.	1023.	1025.	1027.	1051.	1027.	11.8	1.6

RAW QUARTERLY INPUT DATA

259.	259.	256.	255.	251.	260.	251.	254.	264.	258.
252.	253.	254.	258.	266.	257.	255.	259.	253.	259.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	782.	736.	734.	797.	814.	819.	828.	769.	781.		
FORECAST	762.	772.	769.	761.	757.	762.	757.	791.	798.	39.1	-14.7
YL+Y(L+1)	731.	788.	780.	785.	782.	736.	734.	797.	814.	47.9	-12.6
SMITH #1	795.	853.	734.	744.	800.	775.	819.	895.	799.	43.8	17.3
TREND	668.	796.	843.	800.	765.	705.	765.	847.	810.	68.6	-6.7
EXPO SMTH	742.	751.	757.	762.	766.	760.	755.	763.	774.	33.9	-25.6
ADAPT SMTH	756.	757.	788.	780.	785.	789.	778.	771.	779.	25.7	-8.6
METHOD SEL	3	5	3	4	3	6	3	6	6		
FOCUS FORC	795.	853.	774.	744.	765.	775.	779.	895.	779.	54.8	11.0

RAW QUARTERLY INPUT DATA

208.	206.	192.	187.	170.	209.	170.	182.	227.	201.
175.	179.	181.	199.	238.	196.	186.	208.	179.	208.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	870.	828.	824.	884.	900.	905.	913.	858.	869.		
FORECAST	852.	860.	858.	851.	847.	852.	847.	879.	885.	36.2	-13.8
YL+Y(L+1)	823.	875.	848.	873.	870.	828.	826.	884.	900.	44.2	-11.8
SMITH 81	879.	932.	824.	835.	885.	863.	905.	974.	884.	39.9	14.5
TREND	766.	882.	927.	887.	855.	799.	855.	931.	897.	63.5	-6.1
EXPO SMTH	834.	842.	847.	852.	856.	850.	845.	853.	862.	31.2	-23.5
ADAPT SMTH	847.	848.	874.	869.	873.	878.	867.	861.	868.	23.5	-7.3
METHOD SEL	3	5	3	4	3	6	3	6	6		
FOCUS FORC	879.	932.	862.	835.	855.	863.	868.	974.	868.	49.8	9.3

RAW QUARTERLY INPUT DATA

229.	227.	214.	210.	194.	230.	194.	205.	246.	223.
199.	202.	204.	221.	257.	218.	209.	229.	202.	229.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA
DIV CHK AT LOCATION 000367

DIV CHK AT LOCATION 000377

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	61.	0.	0.	91.	91.	91.	101.	10.	21.		
FORECAST	14.	41.	40.	40.	40.	40.	33.	79.	79.	52.9	-7.0
YL+Y(L+1)	14.	76.	63.	62.	62.	2.	2.	93.	93.	65.2	0.1
SMITH 81	854.	854.	0.	0.	0.	0.	91.	1001.	910.	423.3	360.4
TREND	2.	160.	122.	78.	36.	-6.	-20.	173.	85.	94.9	18.1
EXPO SMTH	7.	20.	29.	35.	40.	32.	26.	39.	49.	44.6	-21.0
ADAPT SMTH	0.	0.	61.	61.	61.	61.	0.	0.	5.	37.7	-24.1
METHOD SEL	1	6	3	4	2	6	3	6	5		
FOCUS FORC	14.	41.	5.	0.	36.	2.	5.	1001.	5.	159.0	71.5

RAW QUARTERLY INPUT DATA

10.	4.	0.	1.	1.	14.	1.	1.	61.	1.
1.	1.	1.	1.	91.	0.	0.	10.	0.	11.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	648.	648.	648.	648.	648.	648.	648.	648.	648.		
FORECAST	648.	648.	648.	648.	648.	648.	648.	648.	648.	0.3	-0.3
YL+Y(L+1)	647.	648.	648.	648.	648.	648.	648.	648.	648.	0.1	-0.1
SMITH 81	648.	649.	648.	648.	648.	648.	648.	648.	648.	0.1	0.1
TREND	647.	648.	648.	649.	649.	648.	648.	648.	648.	0.4	0.2
EXPO SMTH	647.	648.	648.	648.	648.	648.	648.	648.	648.	0.3	-0.3
ADAPT SMTH	647.	647.	648.	648.	648.	648.	648.	648.	648.	0.2	-0.2
METHOD SEL	3	2	2	2	2	1	1	1	1		
FOCUS FORC	648.	649.	648.	648.	648.	648.	648.	648.	648.	0.1	0.1

RAW QUARTERLY INPUT DATA

162.	162.	162.	162.	161.	162.	162.	162.	162.	162.
162.	162.	162.	162.	162.	162.	162.	162.	162.	162.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1079.	988.	984.	1109.	1142.	1152.	1168.	1051.	1076.		
FORECAST	1039.	1058.	1054.	1037.	1029.	1040.	1030.	1098.	1111.	77.3	-28.2
YL+Y(L+1)	979.	1092.	1076.	1087.	1079.	988.	984.	1109.	1142.	94.8	-23.7
SMITH #1	1126.	1235.	989.	1008.	1117.	1071.	1155.	1304.	1118.	90.4	41.6
TREND	858.	1110.	1204.	1115.	1047.	927.	1046.	1205.	1133.	135.9	-11.5
EXPO SMTH	999.	1018.	1029.	1041.	1049.	1036.	1026.	1043.	1062.	66.2	-49.5
ADAPT SMTH	1028.	1030.	1091.	1073.	1083.	1091.	1070.	1055.	1071.	51.6	-17.5
METHOD SEL	1	5	3	4	3	6	3	6	6		
FOCUS FORC	1039.	1058.	1062.	1008.	1047.	1071.	1071.	1304.	1071.	91.3	-2.1

RAW QUARTERLY INPUT DATA

294.	290.	262.	253.	219.	297.	218.	245.	332.	281.
229.	237.	241.	277.	354.	270.	251.	293.	237.	295.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	182.	171.	171.	186.	190.	191.	192.	177.	181.		
FORECAST	177.	179.	179.	177.	176.	177.	176.	185.	186.	9.7	-3.5
YL+Y(L+1)	169.	183.	181.	183.	182.	171.	171.	186.	190.	11.7	-2.8
SMITH #1	186.	200.	171.	174.	186.	180.	191.	207.	184.	10.5	4.3
TREND	154.	184.	197.	188.	178.	163.	180.	200.	188.	14.7	-1.0
EXPO SMTH	171.	173.	175.	176.	178.	176.	175.	177.	180.	8.0	-6.6
ADAPT SMTH	175.	175.	183.	180.	181.	183.	181.	179.	181.	6.6	-2.6
METHOD SEL	3	5	3	4	3	6	3	5	6		
FOCUS FORC	186.	200.	180.	174.	178.	180.	181.	207.	180.	13.2	2.9

RAW QUARTERLY INPUT DATA

48.	48.	45.	43.	39.	49.	39.	42.	53.	47.
41.	41.	42.	47.	56.	45.	43.	48.	41.	49.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1005.	958.	956.	1021.	1038.	1042.	1051.	991.	1004.		
FORECAST	984.	994.	992.	983.	979.	985.	980.	1015.	1022.	40.1	-14.9
YL+Y(L+1)	952.	1011.	1003.	1009.	1005.	958.	956.	1021.	1038.	49.0	-12.6
SMITH #1	1016.	1075.	955.	966.	1022.	997.	1042.	1119.	1019.	44.1	16.3
TREND	888.	1020.	1070.	1023.	988.	928.	990.	1072.	1032.	69.9	-6.2
EXPO SMTH	964.	974.	979.	985.	989.	983.	978.	986.	997.	34.3	-25.6
ADAPT SMTH	979.	980.	1011.	1003.	1008.	1013.	1002.	994.	1002.	26.0	-8.2
METHOD SEL	3	5	3	4	3	6	3	6	6		
FOCUS FORC	1016.	1075.	997.	966.	988.	997.	1002.	1119.	1002.	55.3	10.8

RAW QUARTERLY INPUT DATA

264.	262.	247.	243.	225.	265.	224.	238.	284.	257.
230.	234.	237.	253.	295.	251.	241.	264.	235.	264.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	895.	830.	826.	914.	938.	945.	957.	874.	891.		
FORECAST	866.	880.	877.	865.	859.	867.	859.	907.	917.	54.7	-19.4
YL+Y(L+1)	823.	903.	892.	900.	895.	830.	826.	914.	938.	66.8	-16.6
SMITH B1	921.	1000.	829.	843.	919.	885.	945.	1051.	919.	63.0	27.8
TREND	736.	915.	983.	920.	871.	786.	869.	982.	931.	96.6	-8.5
EXPO SMTH	839.	851.	860.	868.	873.	864.	857.	868.	882.	46.4	-34.2
ADAPT SMTH	859.	860.	903.	891.	898.	905.	889.	879.	890.	35.4	-10.5
METHOD SEL	3	5	3	4	3	6	3	6	6		
FOCUS FORC	921.	1000.	882.	843.	871.	885.	890.	1051.	890.	77.3	18.1

RAW QUARTERLY INPUT DATA

241.	238.	218.	212.	188.	243.	187.	205.	268.	232.
195.	200.	203.	228.	283.	224.	210.	240.	200.	241.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	626.	604.	603.	636.	644.	646.	650.	621.	627.		
FORECAST	618.	623.	622.	617.	615.	618.	615.	632.	635.	19.6	-6.9
YL+Y(L+1)	604.	631.	627.	628.	626.	604.	603.	636.	644.	24.4	-6.0
SMITH B1	630.	657.	602.	605.	636.	625.	646.	685.	633.	21.3	6.9
TREND	576.	635.	659.	631.	616.	588.	620.	660.	643.	34.8	-3.4
EXPO SMTH	609.	613.	616.	618.	620.	617.	614.	618.	624.	16.9	-11.9
ADAPT SMTH	616.	616.	631.	626.	628.	629.	624.	620.	624.	13.7	-4.8
METHOD SEL	3	5	3	4	3	6	3	6	3		
FOCUS FORC	630.	657.	624.	605.	616.	625.	624.	685.	624.	27.9	3.4

RAW QUARTERLY INPUT DATA

162.	162.	155.	153.	145.	144.	144.	151.	172.	160.
145.	149.	150.	159.	178.	157.	152.	163.	149.	163.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	990.	947.	945.	1005.	1020.	1024.	1032.	976.	988.		
FORECAST	970.	979.	977.	969.	966.	971.	967.	999.	1005.	37.0	-13.9
YL+Y(L+1)	941.	995.	988.	993.	990.	947.	945.	1005.	1020.	45.2	-11.4
SMITH B1	999.	1054.	944.	954.	1006.	962.	1024.	1095.	1001.	40.3	14.6
TREND	883.	1003.	1049.	1008.	976.	919.	975.	1053.	1015.	64.5	-5.2
EXPO SMTH	950.	959.	965.	971.	974.	969.	964.	972.	982.	31.6	-24.5
ADAPT SMTH	964.	965.	994.	986.	991.	995.	985.	978.	985.	24.8	-9.3
METHOD SEL	3	5	3	4	3	6	3	6	6		
FOCUS FORC	999.	1054.	982.	954.	976.	982.	985.	1095.	985.	51.0	9.4

RAW QUARTERLY INPUT DATA

259.	257.	244.	239.	223.	260.	223.	235.	277.	253.
228.	232.	234.	251.	288.	247.	238.	259.	232.	259.

TREND DEMAND DATA FORECASTS

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	399.	342.	506.	788.	986.	1163.	1346.	1407.	1598.		
FORECAST	139.	208.	204.	210.	244.	315.	390.	555.	693.	619.9	-619.9
YL+Y(L+1)	87.	288.	274.	321.	399.	342.	506.	788.	986.	504.9	-504.9
SMITH 81	14512.	15534.	1972.	2165.	1920.	1334.	1783.	2197.	1879.	3862.5	3862.5
TREND	-20.	455.	482.	444.	505.	585.	911.	1293.	1436.	296.9	-271.8
EXPO SMTH	103.	140.	167.	197.	238.	259.	308.	404.	520.	688.8	-688.8
ADAPT SMTH	130.	132.	216.	216.	245.	283.	293.	385.	606.	669.9	-669.9
METHOD SEL	1	2	4	4	4	3	4	4	4		
FOCUS FORC	139.	208.	274.	444.	505.	585.	1783.	1293.	1436.	304.9	-287.7

RAW QUARTERLY INPUT DATA

65.	62.	36.	28.	1.	68.	1.	19.	200.	54.
48.	97.	143.	218.	330.	295.	320.	481.	391.	486.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	2972.	3234.	3567.	4005.	4368.	4712.	5062.	5303.	5660.		
FORECAST	1050.	1318.	1608.	1930.	2259.	2604.	2932.	3324.	3670.	2021.1	-2021.1
YL+Y(L+1)	1546.	1974.	2297.	2642.	2972.	3234.	3567.	4005.	4368.	1364.2	-1364.2
SMITH 81	3438.	3868.	3780.	4138.	4524.	4757.	5197.	5681.	5798.	255.3	255.3
TREND	2460.	3205.	3744.	4008.	4289.	4529.	4962.	5430.	5704.	139.3	-61.3
EXPO SMTH	1014.	1206.	1424.	1668.	1929.	2190.	2465.	2773.	3092.	2346.9	-2346.9
ADAPT SMTH	1218.	1546.	1974.	2297.	2642.	2972.	3234.	3567.	4005.	1714.2	-1714.2
METHOD SEL	3	4	4	4	4	3	4	4	4		
FOCUS FORC	3438.	3868.	3744.	4008.	4289.	4529.	5197.	5430.	5704.	205.3	147.1

RAW QUARTERLY INPUT DATA

133.	130.	107.	184.	240.	387.	407.	512.	668.	710.
752.	842.	930.	1043.	1190.	1205.	1274.	1393.	1431.	1562.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	706.	783.	889.	1040.	1159.	1271.	1385.	1453.	1570.		
FORECAST	327.	361.	400.	448.	513.	598.	689.	820.	933.	574.4	-574.4
YL+Y(L+1)	320.	412.	488.	600.	706.	783.	889.	1040.	1159.	428.8	-428.8
SMITH 81	698.	936.	965.	1135.	1243.	1289.	1443.	1619.	1629.	79.6	77.8
TREND	318.	524.	714.	861.	1021.	1154.	1343.	1506.	1588.	152.2	-136.5
EXPO SMTH	305.	327.	359.	407.	467.	530.	602.	690.	783.	642.9	-642.9
ADAPT SMTH	310.	317.	348.	400.	491.	608.	742.	867.	1021.	572.6	-572.6
METHOD SEL	3	3	3	3	3	3	4	4	4		
FOCUS FORC	698.	936.	965.	1135.	1243.	1289.	1443.	1506.	1588.	62.5	60.6

RAW QUARTERLY INPUT DATA

90.	89.	79.	76.	65.	91.	64.	100.	157.	167.
176.	206.	234.	273.	327.	325.	346.	387.	395.	442.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	946.	1137.	1482.	1927.	2300.	2655.	3016.	3273.	3640.		
FORECAST	653.	668.	664.	695.	776.	915.	1082.	1352.	1623.	1327.7	-1327.7
YL+T(L+1)	606.	693.	681.	777.	946.	1137.	1482.	1927.	2300.	1091.9	-1091.9
SMITH 81	829.	1167.	1186.	1725.	2410.	2834.	3477.	3949.	3960.	265.7	129.8
TREND	511.	706.	780.	930.	1263.	1675.	2339.	3055.	3555.	618.0	-618.0
EXPO SMTH	622.	636.	645.	672.	726.	809.	943.	1140.	1372.	1423.4	-1423.4
ADAPT SMTH	644.	646.	692.	679.	706.	798.	992.	1317.	1785.	1346.2	-1346.2
METHOD SEL	3	3	3	3	3	3	3	4	4		
FOCUS FORC	829.	1167.	1186.	1725.	2410.	2834.	3477.	3949.	3555.	239.7	84.0

RAW QUARTERLY INPUT DATA

190.	187.	165.	158.	132.	192.	131.	151.	219.	180.
227.	320.	410.	525.	672.	693.	765.	886.	929.	1060.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	414.	444.	495.	578.	638.	692.	748.	771.	829.		
FORECAST	158.	188.	220.	255.	298.	353.	402.	471.	526.	304.4	-304.4
YL+T(L+1)	182.	261.	309.	364.	414.	444.	495.	578.	638.	213.8	-213.8
SMITH 81	535.	664.	536.	601.	667.	688.	772.	872.	858.	65.7	64.9
TREND	240.	386.	498.	559.	613.	637.	719.	810.	844.	46.4	-33.7
EXPO SMTH	133.	158.	188.	223.	262.	298.	337.	386.	436.	354.2	-354.2
ADAPT SMTH	147.	173.	234.	278.	330.	389.	436.	489.	570.	284.8	-284.8
METHOD SEL	3	4	4	4	4	3	3	4	4		
FOCUS FORC	535.	664.	498.	559.	613.	637.	772.	872.	844.	64.7	42.7

RAW QUARTERLY INPUT DATA

38.	37.	30.	28.	20.	52.	45.	65.	99.	100.
100.	115.	129.	151.	183.	175.	183.	207.	206.	233.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA
DIV CHK AT LOCATION 000367

DIV CHK AT LOCATION 000377

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	552.	634.	764.	966.	1117.	1254.	1395.	1461.	1607.		
FORECAST	25.	87.	150.	214.	300.	402.	529.	695.	835.	723.6	-723.6
YL+T(L+1)	46.	170.	293.	424.	552.	634.	764.	966.	1117.	531.6	-531.6
SMITH 81	6027.	6560.	6158.	6398.	1414.	1295.	1512.	1763.	1718.	2566.2	2566.2
TREND	105.	390.	613.	772.	950.	1121.	1317.	1550.	1641.	170.7	-143.2
EXPO SMTH	11.	42.	92.	159.	237.	317.	406.	518.	638.	814.5	-814.5
ADAPT SMTH	0.	41.	164.	292.	424.	552.	634.	764.	966.	657.0	-657.0
METHOD SEL	4	4	4	4	4	3	4	4	4		
FOCUS FORC	105.	390.	613.	772.	950.	1121.	1512.	1550.	1641.	175.1	-121.6

RAW QUARTERLY INPUT DATA

3.	1.	0.	1.	1.	5.	1.	41.	123.	138.
132.	169.	205.	258.	334.	320.	342.	399.	400.	466.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1804.	1971.	2158.	2375.	2570.	2760.	2952.	3113.	3307.		
FORECAST	807.	929.	1069.	1230.	1416.	1607.	1792.	1996.	2187.	1108.8	-1108.8
YL+Y(L+1)	1028.	1242.	1426.	1617.	1804.	1971.	2158.	2375.	2579.	757.7	-757.7
SMITH 81	1991.	2192.	2267.	2455.	2654.	2808.	3022.	3249.	3371.	110.8	110.8
TREND	1435.	1814.	2139.	2376.	2548.	2710.	2926.	3150.	3319.	77.1	-65.9
EXPO SMTH	724.	828.	947.	1081.	1226.	1375.	1531.	1700.	1874.	1302.6	-1302.6
ADAPT SMTH	842.	1028.	1242.	1426.	1617.	1804.	1971.	2158.	2375.	949.7	-949.7
METHOD SEL	3	4	4	4	4	3	4	4	4		
FOCUS FORC	1991.	2192.	2139.	2376.	2548.	2710.	3022.	3150.	3319.	68.8	48.4

RAW QUARTERLY INPUT DATA

151.	150.	143.	141.	181.	246.	274.	327.	395.	430.
465.	514.	562.	617.	682.	709.	752.	809.	843.	903.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA
DIV CHK AT LOCATION 000367

DIV CHK AT LOCATION 000377

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	182.	345.	655.	1080.	1428.	1757.	2091.	2312.	2653.		
FORECAST	6.	24.	24.	39.	97.	196.	347.	574.	806.	1154.8	-1154.8
YL+Y(L+1)	7.	44.	38.	67.	183.	346.	655.	1080.	1428.	961.7	-961.7
SMITH 81	252.	4428.	4206.	13506.	15241.	11861.	12678.	4323.	3253.	6360.5	6360.5
TREND	4.	97.	72.	121.	369.	759.	1325.	2068.	2574.	568.3	-568.3
EXPO SMTH	3.	11.	16.	26.	57.	115.	223.	394.	601.	1228.4	-1228.4
ADAPT SMTH	0.	0.	36.	36.	38.	76.	198.	490.	931.	1188.8	-1188.8
METHOD SEL	3	4	4	4	4	4	4	4	4		
FOCUS FORC	252.	4428.	72.	121.	369.	759.	1325.	2068.	2574.	982.4	-59.5

RAW QUARTERLY INPUT DATA

4.	1.	0.	1.	1.	7.	1.	1.	36.	1.
30.	116.	199.	310.	455.	464.	528.	644.	676.	805.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1286.	1289.	1396.	1658.	1810.	1934.	2066.	2037.	2178.		
FORECAST	579.	700.	807.	899.	1001.	1126.	1226.	1420.	1548.	705.5	-705.5
YL+Y(L+1)	716.	963.	1056.	1182.	1286.	1289.	1396.	1658.	1810.	477.6	-477.6
SMITH 81	1569.	1895.	1464.	1620.	1848.	1851.	2104.	2439.	2270.	183.1	156.1
TREND	976.	1432.	1657.	1664.	1685.	1665.	1920.	2225.	2248.	147.5	-19.2
EXPO SMTH	560.	640.	724.	815.	909.	985.	1067.	1186.	1310.	828.5	-828.5
ADAPT SMTH	627.	684.	817.	886.	1004.	1140.	1246.	1361.	1600.	698.8	-698.8
METHOD SEL	3	4	3	4	3	3	3	4	4		
FOCUS FORC	1569.	1895.	1657.	1620.	1695.	1851.	2104.	2439.	2248.	210.7	158.0

RAW QUARTERLY INPUT DATA

112.	107.	102.	120.	107.	228.	161.	220.	354.	321.
287.	324.	357.	428.	549.	476.	481.	560.	520.	617.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	3966.	4216.	4579.	5109.	5519.	5900.	6289.	6505.	6906.		
FORECAST	1705.	2092.	2460.	2807.	3164.	3546.	3902.	4358.	4743.	2245.5	-2245.5
YL+T(L+1)	2362.	2876.	3224.	3607.	3966.	4216.	4529.	5109.	5519.	1503.4	-1503.4
SMITH #1	4318.	4891.	4747.	5160.	5641.	5877.	6409.	7012.	7050.	240.2	235.1
TREND	3676.	4371.	4862.	5116.	5397.	5611.	6133.	6709.	6979.	175.5	-15.2
EXPO SMTH	1787.	2005.	2249.	2521.	2810.	3091.	3389.	3733.	4090.	2590.6	-2590.6
ADAPT SMTH	2006.	2349.	2851.	3197.	3580.	3949.	4210.	4572.	5101.	1908.1	-1908.1
METHOD SEL	4	4	3	4	3	3	3	4	4		
FOCUS FORC	3676.	4371.	4862.	5160.	5397.	5877.	6409.	7012.	6979.	180.4	83.6

RAW QUARTERLY INPUT DATA

149.	235.	291.	372.	420.	612.	602.	728.	934.	960.
985.	1087.	1184.	1323.	1515.	1497.	1565.	1712.	1731.	1898.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	2549.	2677.	2851.	3093.	3286.	3467.	3652.	3766.	3955.		
FORECAST	1471.	1657.	1831.	1998.	2170.	2352.	2523.	2735.	2918.	1071.4	-1071.4
YL+T(L+1)	1791.	2027.	2194.	2376.	2549.	2677.	2851.	3093.	3286.	716.9	-716.9
SMITH #1	2639.	2894.	2902.	3095.	3323.	3454.	3692.	3961.	4007.	77.5	74.5
TREND	2430.	2739.	2966.	3096.	3236.	3349.	3589.	3850.	3985.	71.7	-6.2
EXPO SMTH	1513.	1616.	1732.	1860.	1998.	2134.	2277.	2440.	2610.	1235.0	-1235.0
ADAPT SMTH	1620.	1791.	2027.	2194.	2376.	2549.	2677.	2851.	3093.	902.0	-902.0
METHOD SEL	3	4	3	3	3	3	3	4	4		
FOCUS FORC	2639.	2894.	2966.	3095.	3323.	3454.	3692.	3961.	3985.	82.2	79.2

RAW QUARTERLY INPUT DATA

232.	274.	303.	342.	368.	454.	456.	513.	604.	621.
638.	684.	732.	795.	880.	879.	913.	980.	994.	1068.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1243.	1569.	1962.	2455.	2876.	3279.	3688.	3993.	4408.		
FORECAST	617.	632.	678.	764.	907.	1113.	1353.	1703.	2060.	1738.7	-1738.7
YL+T(L+1)	570.	657.	744.	951.	1243.	1569.	1962.	2455.	2876.	1382.9	-1382.9
SMITH #1	993.	1517.	1894.	2522.	3223.	3637.	4110.	4631.	4719.	229.2	196.9
TREND	675.	669.	992.	1363.	1893.	2442.	3207.	3968.	4454.	679.1	-669.8
EXPO SMTH	586.	600.	629.	693.	803.	956.	1158.	1417.	1709.	1880.1	-1880.1
ADAPT SMTH	608.	610.	656.	664.	780.	1024.	1370.	1828.	2367.	1729.4	-1729.4
METHOD SEL	3	3	3	3	3	3	3	4	4		
FOCUS FORC	993.	1517.	1894.	2522.	3223.	3637.	4110.	4631.	4454.	249.7	167.4

RAW QUARTERLY INPUT DATA

181.	178.	156.	149.	123.	183.	122.	142.	210.	270.
329.	434.	536.	663.	822.	855.	939.	1072.	1127.	1270.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	746.	708.	764.	959.	1055.	1126.	1204.	1138.	1224.		
FORECAST	552.	580.	591.	595.	617.	664.	700.	826.	901.	322.0	-322.0
YL+Y(L+1)	487.	623.	636.	693.	746.	708.	764.	959.	1055.	250.3	-250.3
SMITH #1	816.	1060.	787.	881.	1086.	1053.	1232.	1491.	1310.	121.4	87.9
TREND	355.	665.	831.	824.	850.	825.	1050.	1305.	1287.	169.7	-103.5
EXPO SMTH	510.	533.	553.	581.	614.	633.	659.	719.	786.	370.6	-370.6
ADAPT SMTH	541.	543.	612.	605.	632.	664.	673.	704.	830.	346.7	-346.7
METHOD SEL	3	4	3	3	3	3	3	4	4		
FOCUS FORC	816.	1060.	831.	881.	1086.	1053.	1232.	1491.	1287.	123.9	90.3

RAW QUARTERLY INPUT DATA

175.	170.	141.	131.	95.	178.	93.	121.	231.	191.
150.	174.	193.	247.	345.	270.	264.	325.	279.	356.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1283.	1564.	1947.	2481.	2907.	3307.	3715.	3966.	4383.		
FORECAST	264.	335.	427.	554.	738.	993.	1272.	1692.	2095.	1909.3	-1909.3
YL+Y(L+1)	193.	422.	597.	902.	1283.	1564.	1947.	2481.	2907.	1473.0	-1473.0
SMITH #1	2385.	4628.	3801.	4511.	4759.	3556.	4121.	4745.	4712.	1296.2	1296.2
TREND	50.	588.	1126.	1586.	2146.	2664.	3427.	4149.	4448.	651.6	-596.4
EXPO SMTH	220.	260.	328.	442.	611.	801.	1030.	1321.	1638.	2100.3	-2100.3
ADAPT SMTH	253.	255.	357.	441.	653.	983.	1367.	1819.	2377.	1894.1	-1894.1
METHOD SEL	1	4	4	4	4	3	4	4	4		
FOCUS FORC	264.	335.	1126.	1586.	2146.	2664.	4121.	4149.	4448.	669.0	-523.6

RAW QUARTERLY INPUT DATA

106.	101.	69.	59.	19.	110.	17.	47.	248.	285.
322.	428.	529.	668.	856.	854.	929.	1076.	1107.	1271.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND-DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	790.	757.	836.	1080.	1206.	1303.	1408.	1342.	1458.		
FORECAST	233.	342.	420.	483.	557.	655.	726.	897.	998.	541.2	-541.2
YL+Y(L+1)	323.	552.	615.	714.	790.	757.	836.	1080.	1206.	367.4	-367.4
SMITH #1	2431.	2798.	975.	1110.	1285.	1227.	1461.	1794.	1575.	514.2	497.4
TREND	502.	910.	1114.	1086.	1084.	1016.	1254.	1543.	1530.	173.5	-15.8
EXPO SMTH	215.	282.	349.	422.	495.	548.	605.	700.	801.	640.3	-640.3
ADAPT SMTH	273.	312.	404.	431.	511.	610.	704.	798.	1014.	569.3	-569.3
METHOD SEL	4	4	3	4	3	3	3	4	4		
FOCUS FORC	502.	910.	1114.	1110.	1084.	1227.	1461.	1794.	1530.	169.2	61.2

RAW QUARTERLY INPUT DATA

29.	44.	30.	40.	17.	138.	57.	111.	246.	201.
156.	137.	213.	280.	400.	313.	310.	385.	334.	429.

SEASONAL DEMAND DATA FORECASTS

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1392.	1399.	1400.	1399.	1399.	1399.	1399.	1401.	1400.		
FORECAST	1404.	1400.	1400.	1397.	1396.	1400.	1401.	1396.	1396.	3.3	0.
YL=Y(L+1)	1400.	1401.	1401.	1397.	1392.	1399.	1400.	1399.	1399.	3.1	-0.4
SMITH #1	1385.	1384.	1388.	1381.	1394.	1402.	1398.	1397.	1403.	7.6	-6.2
TREND	991.	1796.	1803.	986.	987.	1798.	1810.	991.	994.	405.8	-47.9
EXPO SMTH	1440.	1432.	1426.	1419.	1414.	1411.	1409.	1407.	1405.	19.4	19.4
ADAPT SMTH	1557.	1549.	1443.	1497.	1564.	1602.	1637.	1673.	1647.	175.8	175.8
METHOD SEL	3	1	1	1	1	2	3	2	2		
FOCUS FORC	1385.	1384.	1400.	1397.	1396.	1400.	1400.	1397.	1399.	3.8	-3.4

RAW QUARTERLY INPUT DATA

532.	351.	175.	350.	522.	352.	176.	350.	523.	352.
168.	349.	530.	353.	167.	349.	530.	353.	169.	348.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	923.	756.	701.	631.	549.	752.	727.	744.	783.		
FORECAST	668.	642.	676.	795.	750.	670.	718.	792.	736.	105.1	-13.4
YL=Y(L+1)	577.	583.	735.	953.	923.	756.	701.	631.	549.	180.7	-17.6
SMITH #1	1483.	1506.	1530.	1313.	630.	462.	878.	853.	824.	388.0	323.7
TREND	431.	896.	874.	973.	1132.	965.	602.	517.	351.	302.9	19.4
EXPO SMTH	898.	835.	815.	842.	858.	838.	811.	775.	730.	110.3	92.7
ADAPT SMTH	636.	522.	458.	601.	737.	772.	747.	717.	657.	130.5	-79.9
METHOD SEL	5	1	1	1	6	2	1	6	5		
FOCUS FORC	758.	730.	676.	795.	750.	657.	701.	792.	657.	97.3	-5.6

RAW QUARTERLY INPUT DATA

297.	118.	61.	282.	239.	35.	80.	223.	245.	187.
298.	193.	78.	132.	228.	111.	281.	107.	245.	150.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	726.	696.	722.	691.	682.	738.	705.	708.	653.		
FORECAST	688.	671.	677.	695.	683.	670.	711.	711.	704.	36.8	-12.4
YL=Y(L+1)	640.	644.	700.	731.	726.	696.	722.	691.	[illegible]	38.8	-9.9
SMITH #1	730.	746.	773.	763.	688.	655.	777.	697.	723.	46.5	25.4
TREND	543.	723.	747.	697.	762.	794.	791.	637.	621.	62.9	-0.7
EXPO SMTH	736.	717.	714.	717.	719.	714.	716.	711.	705.	21.4	14.4
ADAPT SMTH	659.	620.	592.	639.	666.	678.	684.	696.	685.	51.8	-44.7
METHOD SEL	3	1	5	1	1	5	1	1	2		
FOCUS FORC	730.	746.	677.	705.	683.	670.	705.	711.	704.	28.3	1.1

RAW QUARTERLY INPUT DATA

230.	162.	138.	201.	192.	122.	144.	182.	196.	178.
175.	177.	166.	204.	144.	168.	222.	171.	167.	113.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	855.	808.	842.	817.	794.	848.	787.	788.	753.		
FORECAST	801.	796.	803.	824.	816.	793.	833.	840.	825.	39.9	3.9
YL=Y(L+1)	776.	777.	823.	863.	855.	809.	842.	817.	794.	44.6	7.0
SMITH 81	848.	869.	874.	901.	813.	754.	896.	793.	797.	51.1	30.2
TREND	697.	895.	899.	814.	861.	902.	928.	750.	704.	72.7	17.4
EXPO SMTH	851.	836.	834.	840.	843.	836.	837.	833.	825.	32.3	27.0
ADAPT SMTH	784.	761.	730.	776.	820.	824.	818.	816.	803.	47.8	-12.8
METHOD SEL	6	1	5	4	6	5	6	3	2		
FOCUS FORC	825.	803.	803.	825.	861.	803.	825.	803.	797.	32.4	5.9

RAW QUARTERLY INPUT DATA

249.	192.	159.	225.	238.	160.	161.	217.	239.	206.
201.	209.	192.	240.	176.	186.	246.	179.	177.	151.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1579.	1487.	1556.	1501.	1457.	1573.	1455.	1457.	1375.		
FORECAST	1448.	1453.	1467.	1511.	1493.	1448.	1534.	1548.	1518.	79.7	-0.2
YL=Y(L+1)	1406.	1409.	1512.	1594.	1579.	1487.	1556.	1501.	1457.	91.4	6.8
SMITH 81	1606.	1615.	1638.	1680.	1494.	1378.	1674.	1469.	1484.	109.6	46.3
TREND	1229.	1645.	1662.	1495.	1605.	1693.	1734.	1365.	1277.	150.7	29.5
EXPO SMTH	1576.	1542.	1536.	1548.	1554.	1541.	1544.	1535.	1520.	62.9	50.6
ADAPT SMTH	1426.	1370.	1304.	1404.	1492.	1504.	1497.	1500.	1474.	100.7	-52.4
METHOD SEL	6	1	5	4	1	5	6	3	2		
FOCUS FORC	1530.	1474.	1467.	1520.	1605.	1448.	1520.	1474.	1484.	70.3	8.9

RAW QUARTERLY INPUT DATA

475.	351.	282.	422.	441.	277.	288.	400.	444.	380.
370.	385.	352.	449.	315.	341.	468.	331.	317.	259.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	591.	537.	582.	533.	514.	605.	542.	546.	462.		
FORECAST	522.	498.	508.	540.	521.	497.	564.	567.	553.	48.6	-16.0
YL=Y(L+1)	451.	456.	546.	609.	591.	537.	582.	533.	514.	63.8	-11.3
SMITH 81	668.	689.	734.	688.	529.	469.	698.	577.	614.	114.0	83.8
TREND	297.	660.	634.	540.	640.	699.	702.	441.	404.	106.5	4.9
EXPO SMTH	602.	573.	568.	574.	577:	569.	572.	564.	554.	38.0	26.9
ADAPT SMTH	479.	420.	371.	448.	499.	516.	523.	540.	521.	79.2	-66.2
METHOD SEL	6	1	5	'	1	5	1	2	2		
FOCUS FORC	593.	521.	508.	554.	521.	497.	554.	567.	514.	34.8	-9.4

RAW QUARTERLY INPUT DATA

223.	121.	72.	177.	170.	51.	81.	149.	175.	141.
135.	140.	121.	186.	86.	121.	212.	123.	90.	37.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1481.	1472.	1403.	1328.	1203.	1434.	1380.	1400.	1462.		
FORECAST	1377.	1360.	1402.	1535.	1494.	1392.	1438.	1524.	1442.	128.7	22.1
YL+Y(L+1)	1386.	1311.	1473.	1719.	1681.	1472.	1403.	1328.	1203.	207.4	14.8
SMITH 81	1897.	1904.	1892.	1863.	1319.	1073.	1463.	1405.	1353.	260.7	156.3
TREND	1175.	1719.	1671.	1713.	1893.	1702.	1281.	1135.	924.	362.9	49.9
EXPO SMTH	1436.	1571.	1551.	1585.	1604.	1578.	1543.	1500.	1440.	153.1	138.3
ADAPT SMTH	1350.	1259.	1202.	1378.	1546.	1564.	1516.	1468.	1417.	168.4	-7.0
METHOD SEL	5	1	1	6	3	2	2	3	6		
FOCUS FORC	1448.	1440.	1402.	1535.	1417.	1073.	1403.	1328.	1353.	139.1	-40.5

RAW QUARTERLY INPUT DATA

482.	284.	214.	468.	443.	205.	234.	424.	448.	367.
480.	386.	239.	298.	405.	261.	470.	244.	425.	323.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	404.	372.	363.	333.	343.	411.	434.	440.	431.		
FORECAST	337.	313.	321.	363.	337.	323.	350.	372.	374.	55.8	-49.2
YL+Y(L+1)	270.	274.	336.	410.	404.	372.	363.	333.	343.	78.0	-47.3
SMITH 81	496.	514.	543.	447.	335.	317.	433.	450.	481.	75.6	52.7
TREND	183.	313.	334.	453.	506.	448.	340.	370.	344.	97.9	-26.8
EXPO SMTH	414.	386.	376.	383.	387.	384.	380.	371.	365.	38.7	-9.4
ADAPT SMTH	315.	259.	248.	297.	318.	328.	326.	323.	315.	89.1	-89.1
METHOD SEL	6	5	5	1	1	5	3	3	3		
FOCUS FORC	404.	315.	363.	365.	337.	323.	365.	450.	481.	34.9	-14.1

RAW QUARTERLY INPUT DATA

139.	74.	61.	130.	87.	28.	70.	85.	91.	90.
144.	79.	59.	81.	114.	89.	127.	104.	120.	80.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	890.	906.	906.	904.	904.	905.	905.	910.	910.		
FORECAST	918.	907.	907.	899.	899.	908.	908.	897.	897.	7.8	-0.4
YL+Y(L+1)	907.	909.	909.	890.	890.	906.	906.	904.	904.	7.2	-1.7
SMITH 81	890.	892.	907.	888.	904.	920.	905.	903.	910.	6.1	-2.3
TREND	890.	897.	908.	870.	890.	909.	919.	880.	902.	12.8	-8.4
EXPO SMTH	910.	910.	910.	906.	903.	903.	904.	904.	904.	5.2	1.6
ADAPT SMTH	906.	906.	915.	914.	909.	907.	910.	913.	919.	6.8	6.8
METHOD SEL	3	6	6	1	3	2	3	6	3		
FOCUS FORC	890.	892.	919.	919.	899.	920.	906.	903.	919.	9.0	3.1

RAW QUARTERLY INPUT DATA

243.	229.	227.	229.	219.	229.	230.	229.	221.	229.
211.	229.	237.	229.	209.	229.	238.	229.	214.	229.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	585.	471.	551.	500.	439.	557.	405.	406.	341.		
FORECAST	453.	449.	465.	514.	499.	443.	531.	552.	512.	96.8	17.9
YL+Y(L+1)	413.	414.	510.	604.	585.	471.	551.	500.	439.	104.9	25.8
SMITH B1	1192.	1181.	1208.	1311.	502.	371.	776.	606.	607.	430.0	388.7
TREND	249.	702.	698.	485.	581.	679.	751.	343.	221.	169.1	50.5
EXPO SMTH	568.	537.	532.	546.	554.	537.	540.	532.	513.	79.6	67.1
ADAPT SMTH	427.	377.	295.	391.	489.	500.	488.	488.	463.	112.6	-37.4
METHOD SEL	6	1	5	1	6	5	6	4	2		
FOCUS FORC	492.	463.	465.	513.	499.	463.	513.	463.	221.	71.0	-17.8

RAW QUARTERLY INPUT DATA

216.	94.	16.	166.	208.	30.	20.	155.	209.	126.
114.	136.	95.	206.	63.	75.	213.	54.	64.	10.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	14.	14.	15.	9.	16.	24.	35.	36.	30.		
FORECAST	12.	7.	8.	15.	10.	10.	11.	14.	17.	11.5	-10.3
YL+Y(L+1)	2.	3.	4.	16.	15.	14.	16.	11.	17.	12.1	-10.6
SMITH B1	2.	2.	9.	-33.	26.	26.	43.	69.	77.	17.0	10.2
TREND	-10.	0.	-2.	22.	24.	16.	14.	24.	28.	13.3	-8.5
EXPO SMTH	22.	18.	15.	15.	15.	15.	15.	13.	14.	9.7	-5.8
ADAPT SMTH	11.	3.	3.	4.	9.	12.	14.	17.	13.	11.8	-11.8
METHOD SEL	1	6	5	1	2	3	3	4	4		
FOCUS FORC	12.	7.	13.	14.	10.	14.	43.	69.	28.	8.3	1.8

RAW QUARTERLY INPUT DATA

11.	1.	0.	9.	1.	1.	2.	1.	1.	1.
13.	1.	1.	2.	7.	7.	8.	13.	8.	1.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1515.	1398.	1361.	1310.	1256.	1403.	1389.	1402.	1427.		
FORECAST	1336.	1315.	1338.	1424.	1391.	1334.	1370.	1423.	1386.	76.1	-16.3
YL+Y(L+1)	1266.	1270.	1379.	1536.	1515.	1398.	1361.	1310.	1256.	130.7	-18.9
SMITH B1	1566.	1590.	1591.	1577.	1301.	1164.	1401.	1378.	1376.	123.3	-3.7
TREND	1155.	1485.	1472.	1554.	1669.	1548.	1291.	1238.	1125.	213.6	8.5
EXPO SMTH	1500.	1454.	1439.	1458.	1470.	1455.	1436.	1411.	1380.	74.1	60.2
ADAPT SMTH	1311.	1226.	1179.	1280.	1375.	1401.	1385.	1365.	1321.	95.2	-68.9
METHOD SEL	5	1	2	1	6	2	3	6	5		
FOCUS FORC	1403.	1380.	1338.	1536.	1391.	1321.	1361.	1378.	1321.	83.5	-3.4

RAW QUARTERLY INPUT DATA

429.	300.	259.	417.	383.	238.	273.	372.	387.	347.
430.	351.	270.	310.	379.	297.	417.	296.	392.	322.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	346.	365.	365.	365.	365.	367.	367.	367.	366.		
FORECAST	358.	346.	346.	346.	346.	357.	357.	356.	356.	14.6	-11.9
YL+Y(L+1)	344.	347.	347.	346.	346.	366.	366.	365.	365.	9.0	-9.0
SMITH 81	263.	268.	275.	274.	274.	294.	287.	286.	286.	85.0	-85.0
TREND	83.	569.	547.	151.	125.	615.	582.	177.	137.	220.5	-32.1
EXPO SMTH	355.	353.	352.	350.	350.	353.	355.	357.	359.	11.9	-10.0
ADAPT SMTH	418.	413.	348.	377.	411.	433.	457.	485.	496.	66.5	62.8
METHOD SEL	2	5	5	5	6	2	2	2	2		
FOCUS FORC	344.	347.	359.	359.	359.	496.	366.	365.	365.	19.1	9.6

RAW QUARTERLY INPUT DATA

210.	81.	0.	81.	182.	82.	1.	80.	184.	82.
1.	80.	203.	82.	1.	80.	205.	82.	0.	79.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	486.	418.	470.	422.	393.	489.	405.	408.	332.		
FORECAST	403.	385.	396.	431.	414.	382.	452.	460.	440.	59.3	-7.0
YL+Y(L+1)	341.	345.	434.	497.	486.	418.	470.	422.	393.	70.3	-1.9
SMITH 81	666.	681.	721.	673.	623.	543.	620.	495.	523.	179.0	146.5
TREND	188.	520.	545.	423.	520.	586.	608.	316.	258.	118.8	15.7
EXPO SMTH	491.	462.	456.	464.	469.	458.	461.	453.	441.	46.7	36.8
ADAPT SMTH	364.	311.	260.	342.	407.	420.	418.	425.	403.	78.1	-52.5
METHOD SEL	6	1	5	4	1	5	6	6	2		
FOCUS FORC	464.	403.	396.	441.	520.	382.	441.	403.	403.	52.9	3.3

RAW QUARTERLY INPUT DATA

193.	89.	34.	148.	153.	23.	41.	124.	157.	112.
104.	113.	89.	164.	56.	84.	185.	80.	59.	8.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	190.	186.	195.	170.	178.	216.	220.	223.	171.		
FORECAST	182.	160.	163.	172.	160.	160.	187.	181.	184.	25.8	-22.6
YL+Y(L+1)	129.	133.	179.	191.	190.	186.	195.	170.	178.	30.9	-22.0
SMITH 81	555.	572.	614.	209.	171.	176.	241.	209.	246.	151.8	138.3
TREND	49.	148.	182.	183.	238.	252.	225.	148.	165.	42.9	-17.8
EXPO SMTH	210.	195.	192.	192.	191.	190.	191.	187.	185.	19.1	-1.8
ADAPT SMTH	152.	122.	118.	154.	159.	163.	168.	177.	169.	40.7	-40.7
METHOD SEL	6	5	5	1	3	5	4	3	4		
FOCUS FORC	234.	169.	185.	185.	160.	176.	185.	148.	246.	36.6	-6.8

RAW QUARTERLY INPUT DATA

91.	44.	31.	68.	43.	4.	37.	45.	47.	50.
49.	44.	43.	59.	24.	52.	81.	63.	27.	0.

CYCLICAL DEMAND DATA FORECASTS

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1150.	1214.	1246.	1199.	1186.	1079.	1045.	996.	983.		
FORECAST	1127.	1098.	1074.	1083.	1067.	1092.	1138.	1165.	1168.	111.8	-9.9
YL=Y(L+1)	984.	969.	1029.	1130.	1150.	1214.	1246.	1199.	1186.	163.9	1.0
SMITH #1	1104.	1154.	1294.	1368.	1238.	1267.	1130.	1012.	993.	74.7	51.2
TREND	786.	805.	905.	1181.	1284.	1444.	1405.	1319.	1189.	275.8	24.3
EXPO SMTH	1136.	1102.	1088.	1096.	1107.	1128.	1152.	1161.	1166.	107.9	4.3
ADAPT SMTH	1035.	973.	948.	985.	1020.	1048.	1106.	1162.	1185.	165.9	-76.8
METHOD SEL	1	3	3	4	2	1	6	3	3		
FOCUS FORC	1127.	1098.	1294.	1368.	1284.	1214.	1138.	1185.	993.	97.7	66.7

RAW QUARTERLY INPUT DATA

317. 323. 319. 310. 275. 214. 236. 259. 260. 274.
337. 279. 324. 306. 290. 266. 217. 272. 241. 253.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	692.	717.	736.	716.	706.	663.	641.	619.	606.		
FORECAST	673.	659.	647.	653.	649.	657.	682.	697.	699.	56.1	-9.1
YL=Y(L+1)	605.	597.	627.	678.	692.	717.	736.	716.	706.	79.3	-2.4
SMITH #1	665.	692.	754.	795.	738.	738.	688.	624.	611.	34.7	23.2
TREND	508.	518.	569.	712.	764.	824.	813.	784.	715.	135.6	12.3
EXPO SMTH	671.	656.	650.	656.	663.	674.	686.	692.	695.	54.3	-5.8
ADAPT SMTH	627.	600.	586.	604.	623.	640.	666.	696.	710.	84.0	-38.3
METHOD SEL	5	3	3	4	2	5	6	3	3		
FOCUS FORC	740.	695.	754.	795.	764.	717.	695.	710.	611.	47.7	42.8

RAW QUARTERLY INPUT DATA

185. 189. 187. 179. 166. 135. 147. 157. 158. 165.
198. 171. 183. 184. 178. 161. 140. 162. 156. 148.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	585.	697.	789.	868.	706.	484.	353.	294.	273.		
FORECAST	206.	253.	300.	396.	487.	542.	637.	662.	646.	342.9	-102.6
YL=Y(L+1)	387.	386.	485.	455.	585.	697.	789.	868.	706.	333.7	34.3
SMITH #1	28182.	22627.	22827.	996.	1209.	854.	652.	370.	128.	8120.2	8088.5
TREND	615.	694.	668.	806.	813.	1044.	907.	1317.	723.	323.4	281.9
EXPO SMTH	157.	202.	259.	298.	355.	424.	497.	571.	598.	353.3	-187.4
ADAPT SMTH	137.	176.	144.	238.	374.	512.	645.	748.	833.	434.4	-138.1
METHOD SEL	4	4	4	4	2	1	5	3	3		
FOCUS FORC	615.	694.	668.	806.	813.	1044.	637.	598.	128.	179.2	105.9

RAW QUARTERLY INPUT DATA

19. 6. 0. 1. 112. 1. 222. 33. 110. 100.
192. 183. 222. 192. 271. 21. 0. 61. 212. 0.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	232.	364.	471.	519.	504.	415.	292.	160.	67.		
FORECAST	327.	276.	225.	197.	190.	216.	265.	323.	368.	195.1	-70.9
YL+Y(L+1)	148.	68.	59.	127.	232.	364.	471.	519.	504.	275.8	-59.1
SMITH #1	34.	320.	876.	1229.	1383.	1215.	706.	356.	186.	418.3	364.6
TREND	-150.	-277.	-233.	11.	307.	622.	807.	868.	737.	503.6	-37.0
EXPO SMTH	364.	305.	256.	230.	230.	257.	300.	344.	376.	180.8	-40.3
ADAPT SMTH	266.	148.	68.	56.	84.	146.	246.	349.	436.	267.7	-136.1
METHOD SEL	2	5	5	5	4	2	1	6	3		
FOCUS FORC	148.	68.	376.	376.	376.	622.	471.	323.	436.	184.9	19.0

RAW QUARTERLY INPUT DATA

109.	135.	140.	121.	88.	41.	16.	3.	8.	32.
84.	108.	140.	139.	132.	93.	51.	16.	0.	0.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	811.	553.	348.	268.	247.	504.	680.	835.	1055.		
FORECAST	665.	657.	656.	552.	573.	565.	615.	583.	529.	230.1	10.1
YL+Y(L+1)	334.	576.	881.	898.	811.	553.	348.	268.	247.	442.6	-42.8
SMITH #1	1407.	1495.	1285.	484.	210.	59.	2462.	2431.	19171.	2740.9	2633.7
TREND	-105.	410.	1174.	1222.	1094.	537.	256.	-316.	-263.	734.6	-143.6
EXPO SMTH	301.	356.	461.	549.	601.	591.	543.	488.	440.	293.5	-107.9
ADAPT SMTH	205.	186.	367.	655.	695.	734.	613.	392.	379.	360.2	-119.5
METHOD SEL	1	2	5	6	3	4	6	6	1		
FOCUS FORC	665.	657.	881.	440.	379.	59.	256.	379.	379.	343.2	-134.2

RAW QUARTERLY INPUT DATA

287.	333.	288.	87.	30.	25.	63.	216.	272.	330.
80.	129.	14.	125.	1.	108.	271.	301.	155.	328.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	64.	166.	221.	317.	354.	328.	297.	170.	100.		
FORECAST	210.	173.	125.	92.	60.	86.	113.	126.	210.	145.6	-86.1
YL+Y(L+1)	51.	2.	2.	33.	66.	167.	221.	317.	354.	178.4	-89.3
SMITH #1	0.	0.	31.	1769.	1975.	2159.	2098.	448.	313.	846.1	752.8
TREND	-177.	-256.	-253.	-112.	67.	359.	401.	592.	568.	319.8	-92.0
EXPO SMTH	259.	207.	166.	139.	124.	132.	150.	183.	218.	130.4	-48.7
ADAPT SMTH	148.	51.	0.	0.	31.	62.	99.	147.	222.	185.4	-139.7
METHOD SEL	2	1	5	5	5	4	2	1	6		
FOCUS FORC	51.	2.	125.	218.	218.	218.	401.	317.	210.	108.9	-28.7

RAW QUARTERLY INPUT DATA

77.	96.	99.	97.	51.	1.	1.	1.	1.	1.
31.	33.	102.	55.	127.	70.	76.	24.	0.	0.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	918.	1172.	1355.	1415.	1399.	1226.	1017.	713.	504.		
FORECAST	1014.	916.	813.	792.	781.	837.	942.	1073.	1159.	401.8	-155.1
YL=Y(L+1)	643.	501.	528.	731.	918.	1172.	1355.	1415.	1399.	542.4	-117.4
SMITH B1	614.	836.	1273.	1823.	1878.	1918.	1605.	1055.	740.	387.5	226.9
TREND	45.	-148.	-27.	640.	1171.	1765.	1952.	2114.	1850.	977.7	-39.9
EXPO SMTH	1061.	949.	865.	838.	854.	918.	1005.	1087.	1149.	368.7	-110.4
ADAPT SMTH	852.	643.	501.	524.	609.	751.	965.	1149.	1317.	545.1	-267.6
METHOD SEL	1	5	3	3	4	2	1	6	3		
FOCUS FORC	1014.	916.	1149.	1823.	1878.	1765.	1355.	1073.	1317.	388.4	285.7

RAW QUARTERLY INPUT DATA

319.	368.	372.	326.	264.	135.	127.	117.	122.	162.
330.	304.	376.	345.	390.	288.	203.	136.	86.	79.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	402.	398.	408.	381.	390.	430.	434.	438.	380.		
FORECAST	392.	369.	372.	382.	370.	370.	399.	392.	396.	28.2	-24.4
YL=Y(L+1)	337.	341.	390.	403.	402.	398.	408.	381.	390.	33.2	-23.4
SMITH B1	415.	437.	480.	422.	381.	387.	448.	414.	454.	36.7	19.8
TREND	253.	358.	394.	394.	453.	469.	441.	357.	377.	45.4	-18.3
EXPO SMTH	423.	406.	403.	403.	403.	402.	403.	399.	397.	20.5	-2.4
ADAPT SMTH	361.	330.	325.	363.	368.	373.	378.	388.	380.	43.9	-43.9
METHOD SEL	6	5	5	1	3	5	4	3	4		
FOCUS FORC	447.	380.	397.	397.	370.	387.	397.	357.	454.	38.4	-8.4

RAW QUARTERLY INPUT DATA

146.	97.	82.	122.	96.	54.	89.	98.	100.	103.
102.	97.	96.	113.	75.	106.	136.	117.	79.	48.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	757.	983.	1092.	1241.	1418.	1469.	1557.	1439.	1368.		
FORECAST	1332.	1230.	1094.	991.	900.	907.	901.	971.	1058.	395.4	-212.4
YL=Y(L+1)	1043.	830.	710.	700.	757.	983.	1092.	1241.	1418.	358.0	-283.3
SMITH B1	565.	613.	851.	1122.	1342.	1805.	1741.	1848.	1748.	255.4	33.7
TREND	557.	164.	-29.	176.	495.	1181.	1315.	1707.	1957.	617.2	-417.8
EXPO SMTH	1450.	1326.	1203.	1102.	1033.	1023.	1037.	1078.	1146.	357.8	-102.9
ADAPT SMTH	1282.	1043.	830.	710.	700.	749.	833.	936.	1024.	487.5	-357.5
METHOD SEL	3	2	1	5	3	4	3	2	2		
FOCUS FORC	565.	613.	710.	991.	1146.	1805.	1315.	1848.	1418.	270.2	-101.4

RAW QUARTERLY INPUT DATA

358.	414.	431.	417.	368.	262.	235.	178.	155.	142.
225.	235.	381.	251.	374.	412.	432.	339.	256.	341.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	132.	102.	102.	174.	130.	114.	210.	126.	101.		
FORECAST	193.	173.	140.	128.	162.	170.	139.	135.	132.	46.1	19.9
YL+Y(L+1)	190.	236.	175.	95.	133.	103.	102.	174.	131.	60.4	16.4
SMITH 81	2812.	2911.	105.	105.	461.	367.	367.	8911.	8551.	2615.2	2599.8
TREND	141.	220.	157.	128.	157.	14.	-54.	212.	187.	87.8	-3.2
EXPO SMTH	71.	104.	118.	114.	117.	114.	112.	124.	125.	30.8	-21.2
ADAPT SMTH	97.	129.	165.	188.	115.	106.	91.	84.	78.	38.5	-15.3
METHOD SEL	4	6	5	6	2	6	1	1	6		
FOCUS FORC	141.	220.	78.	125.	78.	103.	78.	135.	132.	48.1	-11.1

RAW QUARTERLY INPUT DATA

89.	65.	42.	1.	1.	61.	97.	32.	46.	1.
17.	69.	16.	1.	89.	25.	0.	96.	5.	0.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	295.	446.	499.	566.	671.	690.	751.	676.	647.		
FORECAST	619.	557.	473.	418.	364.	376.	371.	411.	483.	226.6	-130.2
YL+Y(L+1)	433.	305.	243.	256.	295.	446.	499.	566.	671.	205.7	-169.7
SMITH 81	185.	214.	349.	561.	654.	985.	924.	963.	918.	171.1	57.0
TREND	123.	-103.	-208.	-31.	166.	616.	631.	837.	1001.	360.0	-245.6
EXPO SMTH	687.	610.	537.	481.	444.	444.	455.	477.	516.	197.6	-65.7
ADAPT SMTH	579.	433.	305.	243.	256.	303.	368.	431.	449.	271.4	-208.3
METHOD SEL	3	1	1	3	3	4	4	2	2		
FOCUS FORC	185.	214.	473.	418.	654.	985.	631.	837.	671.	126.0	-19.3

RAW QUARTERLY INPUT DATA

173.	208.	217.	206.	177.	102.	94.	60.	49.	40.
107.	99.	200.	93.	174.	284.	219.	154.	99.	175.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1071.	1008.	955.	1041.	1126.	1180.	1194.	1077.	961.		
FORECAST	1125.	1117.	1099.	1035.	1061.	1069.	1077.	1096.	1099.	84.8	18.1
YL+Y(L+1)	1050.	1129.	1199.	1131.	1071.	1008.	955.	1061.	1126.	122.6	10.8
SMITH 81	1209.	1154.	1089.	898.	1036.	1102.	1160.	1322.	1148.	135.1	53.9
TREND	935.	1129.	1284.	1177.	1076.	987.	846.	986.	1149.	174.6	-7.2
EXPO SMTH	968.	1000.	1040.	1058.	1061.	1050.	1031.	1037.	1055.	76.8	-37.2
ADAPT SMTH	964.	1025.	1101.	1173.	1158.	1112.	1049.	999.	1019.	84.8	-3.9
METHOD SEL	2	5	5	1	6	6	3	2	6		
FOCUS FORC	1050.	1129.	1055.	1055.	1061.	1019.	1019.	1322.	1126.	117.7	22.5

RAW QUARTERLY INPUT DATA

333.	332.	300.	235.	237.	227.	279.	307.	316.	297.
211.	247.	253.	244.	317.	312.	307.	258.	200.	196.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	1155.	1182.	1193.	1223.	1233.	1195.	1207.	1111.	1062.		
FORECAST	1177.	1166.	1155.	1156.	1136.	1152.	1172.	1202.	1194.	60.2	-5.9
YL=Y(L+1)	1117.	1122.	1150.	1180.	1155.	1182.	1193.	1223.	1233.	63.6	-0.7
SMITH 81	1171.	1165.	1215.	1226.	1196.	1259.	1208.	1239.	1142.	41.0	20.8
TREND	1057.	1082.	1100.	1180.	1188.	1273.	1228.	1306.	1257.	96.5	12.2
EXPO SMTH	1190.	1176.	1171.	1173.	1169.	1172.	1176.	1185.	1195.	48.7	5.1
ADAPT SMTH	1131.	1103.	1102.	1130.	1141.	1139.	1140.	1146.	1173.	72.1	-39.6
METHOD SEL	6	5	5	3	3	2	3	6	3		
FOCUS FORC	1236.	1173.	1195.	1195.	1196.	1259.	1193.	1239.	1173.	52.7	33.2

RAW QUARTERLY INPUT DATA

311.	308.	305.	312.	285.	257.	277.	298.	290.	285.
307.	273.	317.	296.	337.	283.	279.	308.	241.	234.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	199.	249.	330.	381.	347.	246.	213.	243.	333.		
FORECAST	305.	280.	241.	229.	258.	301.	311.	303.	273.	82.2	-4.6
YL=Y(L+1)	317.	353.	291.	225.	199.	249.	330.	381.	347.	93.0	16.8
SMITH 81	564.	311.	160.	297.	412.	422.	389.	284.	177.	143.8	52.8
TREND	292.	342.	305.	265.	189.	242.	348.	445.	374.	96.2	28.9
EXPO SMTH	138.	181.	203.	208.	206.	215.	238.	266.	282.	77.7	-67.1
ADAPT SMTH	233.	317.	363.	344.	297.	267.	275.	292.	320.	40.7	18.6
METHOD SEL	6	6	6	6	6	2	5	5	2		
FOCUS FORC	292.	320.	320.	320.	320.	320.	330.	282.	282.	60.3	27.5

RAW QUARTERLY INPUT DATA

114.	105.	64.	9.	29.	88.	107.	93.	65.	26.
41.	67.	115.	107.	92.	33.	14.	74.	122.	123.

FORECASTS BASED ON ALTERNATIVE METHODS FOR IDENTICAL DEMAND DATA

QUARTER	1	2	3	4	5	6	7	8	9	MAD	BIAS
ACT DEMAND	46.	179.	282.	282.	305.	287.	174.	299.	240.		
FORECAST	149.	77.	59.	59.	67.	112.	168.	148.	177.	142.9	-120.2
YL=Y(L+1)	86.	41.	51.	12.	47.	180.	283.	282.	305.	137.2	-89.7
SMITH 81	400.	400.	1730.	1366.	1366.	1559.	327.	316.	7691.	1451.2	1451.2
TREND	-142.	-12.	25.	-42.	23.	372.	530.	421.	403.	218.6	-57.2
EXPO SMTH	89.	79.	73.	61.	58.	82.	122.	154.	184.	142.0	-132.5
ADAPT SMTH	82.	74.	41.	52.	46.	52.	71.	147.	155.	160.7	-152.8
METHOD SEL	2	5	5	5	1	4	1	3	1		
FOCUS FORC	86.	41.	184.	184.	184.	112.	530.	148.	7691.	958.6	765.8

RAW QUARTERLY INPUT DATA

144.	47.	0.	20.	45.	1.	40.	1.	1.	10.
1.	36.	133.	113.	1.	59.	115.	0.	125.	0.

APPENDIX I

GENERATED DATA PARAMETER RANGES

This appendix contains a table of data generated, a sample program, and a plot of the first series of generated data for each demand pattern simulated (normal, trend, seasonal, and cyclical). The values of the parameters used in each simulation program were selected from random numbers in the ranges shown for each parameter in Table 1. Data points were rounded to whole units, and negative numbers set to zero, and then entered in the program used for forecasting (see Appendix G).

Table 5

Generated Data Parameter Ranges

Data Type	Parameter	Range
Normal	Uniform distribution value	1-300
	Randomness factor	1-100
Trend	Slope (increase per quarter)	1-100
	Initial value	0-199
	Start ramp at time	1-10
	Randomness	1-100
Seasonal	Average value of sine function	1-40
	Amplitude of sine	1-200
	Randomness in amplitude	1-100
	Period of sine function	4
	Randomness of period	0-2
Cyclical	Average value of sine function	1-300
	Amplitude of sine function	1-200
	Randomness of amplitude	1-100
	Period of sine function	4-13
	Randomness of period	1-5

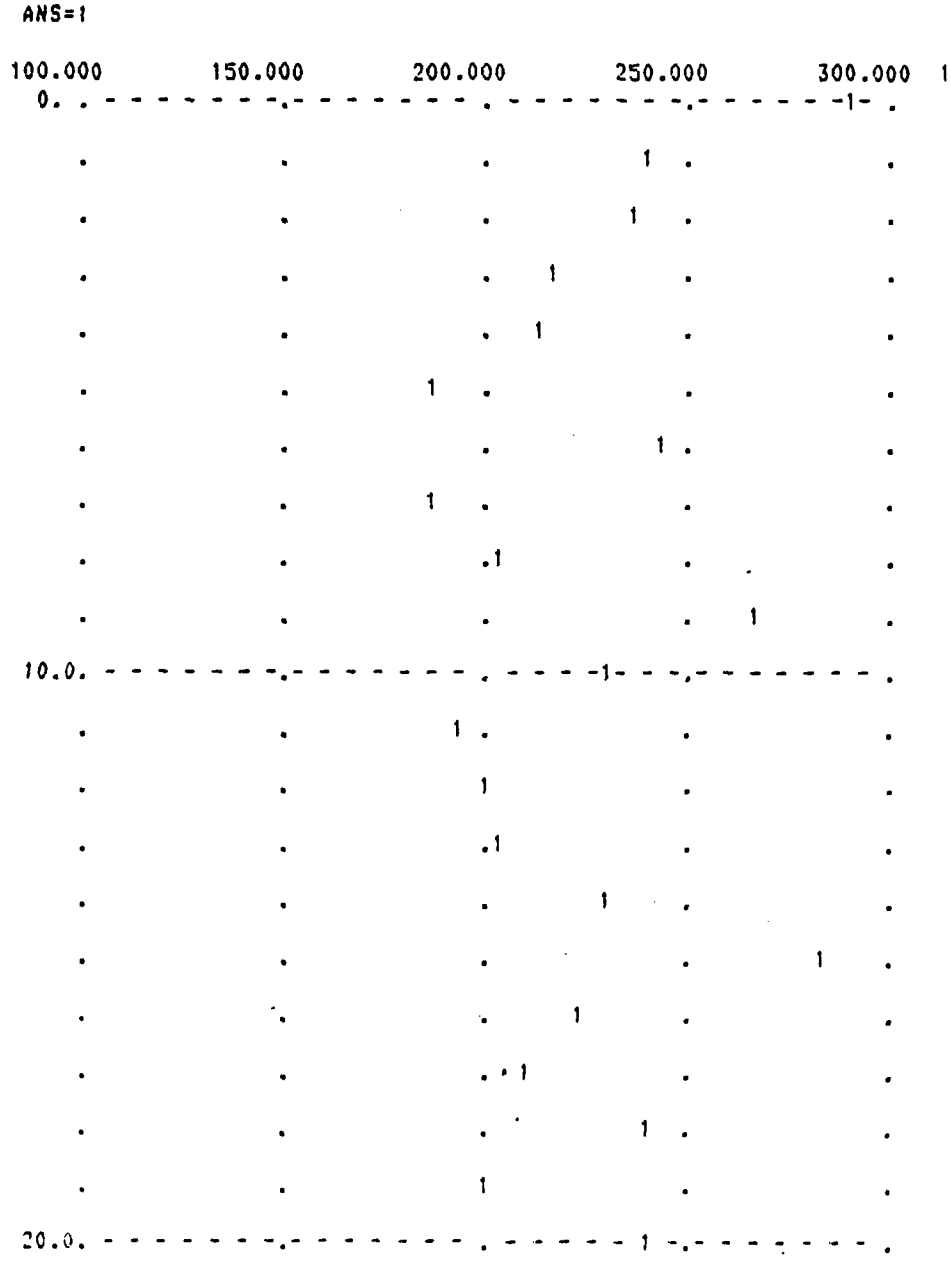
```
DYNAMO - F, VERSION 4.11      04/29/80     17.50

 *  ANS2

 L  PROB.K=PROB.J+(DT)(RATE.JK)

 N  PROB=10

 R  RATE.KL=PROB.K*ANS.K

 A  ANS.K=238+(NOISE()*104)

 SPEC  DT=.1/LENGTH=20/PLTPER=1/PRTPER=1

 PRINT  ANS

 PLOT  ANS

 RUN
```

PAGE 1 ANS2

TIME E+00	ANS E+00
0.	288.65
1.000	240.52
2.000	237.67
3.000	218.10
4.000	212.00
5.000	187.68
6.000	242.74
7.000	186.81
8.000	204.95
9.000	267.62
10.000	231.54
11.000	194.81
12.000	200.24
13.000	203.19
14.000	228.50
15.000	283.37
16.000	223.54
17.000	210.17
18.000	240.37
19.000	200.42
20.000	241.24

TIME E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00
0.	179.53	291.09	235.56	215.16	274.04	243.25	266.79
1.000	162.87	259.70	148.56	149.45	239.80	216.41	259.39
2.000	161.89	256.78	143.41	145.55	237.77	214.82	258.95
3.000	155.11	243.61	108.03	118.83	223.84	203.90	255.94
4.000	153.00	239.50	97.00	110.50	219.50	200.50	255.00
5.000	144.58	223.13	53.04	77.30	202.20	186.94	251.26
6.000	163.64	260.19	152.57	152.47	241.37	217.64	259.73
7.000	144.28	222.55	51.47	76.11	201.58	186.45	251.13
8.000	150.56	234.76	84.26	100.88	214.49	196.57	253.92
9.000	172.25	276.93	197.54	186.44	259.07	231.52	263.56
10.000	159.76	252.65	132.31	137.17	233.40	211.40	258.01
11.000	147.05	227.93	65.93	87.04	207.27	190.92	252.36
12.000	148.93	231.59	75.75	94.45	211.13	193.94	253.19
13.000	149.95	233.57	81.07	98.46	213.23	195.58	253.64
14.000	158.71	250.61	126.83	133.03	231.24	209.70	257.54
15.000	177.70	287.54	226.01	207.95	270.28	240.30	265.98
16.000	157.00	247.27	117.87	126.26	227.71	206.94	256.78
17.000	152.37	238.27	93.70	108.01	218.20	199.48	254.72
18.000	162.82	258.60	148.29	149.24	239.69	216.32	259.37
19.000	148.99	231.71	76.07	94.69	211.26	194.04	253.22
20.000	163.12	259.18	149.85	150.42	240.30	216.81	259.50

TIME E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00
0.	242.04	260.12	101.43	162.49	361.11	56.767	299.01
1.000	207.80	228.65	9.80	162.02	293.54	48.437	263.84
2.000	205.77	226.79	4.38	162.00	289.54	47.943	261.76
3.000	191.84	213.99	-32.88	161.81	262.07	44.556	247.46
4.000	187.50	210.00	-44.50	161.75	253.50	43.500	243.00
5.000	170.20	194.10	-90.80	161.52	219.36	39.291	225.23
6.000	209.37	230.10	14.02	162.05	296.65	48.820	265.46
7.000	169.58	193.53	-92.45	161.51	218.14	39.141	224.60
8.000	182.49	205.39	-57.91	161.68	243.61	42.280	237.85
9.000	227.07	246.36	61.38	162.28	331.58	53.126	283.64
10.000	201.40	222.77	-7.31	161.94	280.93	46.881	257.28
11.000	175.27	198.76	-77.22	161.58	229.37	40.526	230.44
12.000	179.13	202.31	-66.88	161.64	236.99	41.465	234.41
13.000	181.23	204.24	-61.28	161.67	241.13	41.974	236.56
14.000	199.24	220.79	-13.08	161.91	276.67	46.357	255.06
15.000	238.28	256.66	91.37	162.44	353.69	55.852	295.15
16.000	195.71	217.55	-22.52	161.86	269.71	45.498	251.44
17.000	186.20	208.81	-47.98	161.73	250.94	43.184	241.67
18.000	207.69	228.55	9.52	162.02	293.33	48.411	263.73
19.000	179.26	202.43	-66.55	161.64	237.24	41.496	234.54
20.000	208.30	229.12	11.16	162.03	294.54	48.560	264.37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100.000
150.000
200.000
250.000
300.000
1
0.
10.0.
20.0.

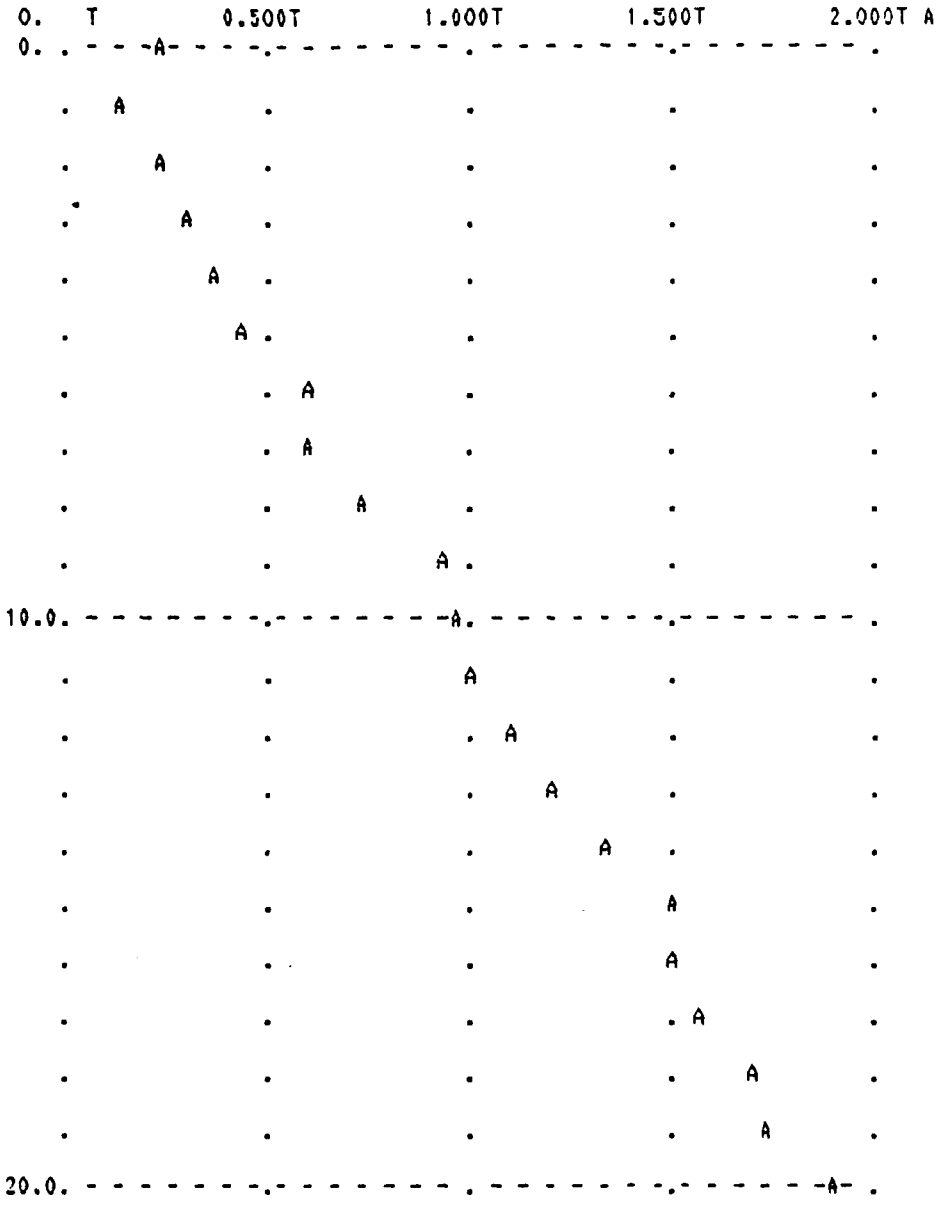
```
DYNAMO - F, VERSION 4.11      04/29/80     14.59

 *  ANS2

 L  PROB.K=PROB.J+(DT)(RATE.JK)

 N  PROB=10

 R  RATE.KL=PROB.K*ANS.K

 A  ANS.K=144+RAMP(92,1)+(NOISE()*190)

 SPEC  DT=.1/LENGTH=20/PRTPER=1/PLTPER=1

 PRINT  ANS

 PLOT  ANS=A

 RUN
```

```
PAGE   1  ANS2
   TIME      ANS
   E+00     E+00
  0.       236.5
  1.000    148.6
  2.000    235.4
  3.000    291.7
  4.000    372.5
  5.000    420.1
  6.000    612.7
  7.000    602.5
  8.000    727.6
  9.000    934.1
 10.000    960.2
 11.000    985.1
 12.000   1087.0
 13.000   1104.4
 14.000   1322.7
 15.000   1514.9
 16.000   1497.6
 17.000   1565.2
 18.000   1712.3
 19.000   1731.3
 20.000   1897.9
```

TIME E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00
0.	268.0	233.5	247.95	185.8	115.56	166.56	61.39
1.000	231.9	180.8	174.83	106.2	28.56	150.83	4.01
2.000	273.8	177.6	170.50	101.5	44.41	149.39	0.61
3.000	303.1	156.2	140.77	69.1	30.03	143.50	-22.72
4.000	342.5	149.5	131.50	59.0	40.00	141.50	-30.00
5.000	368.3	122.8	94.55	18.8	17.04	180.55	-59.00
6.000	453.6	183.2	178.20	109.8	137.57	245.55	6.65
7.000	455.6	121.9	93.24	17.3	57.47	274.27	-60.03
8.000	513.2	141.8	120.80	47.3	111.26	327.20	-38.40
9.000	604.2	210.5	230.99	248.0	245.54	394.68	36.31
10.000	621.2	269.9	191.18	285.3	201.32	429.89	-6.71
11.000	637.6	328.7	150.39	321.6	155.93	464.88	29.51
12.000	685.7	433.6	173.64	427.6	186.75	513.66	115.98
13.000	731.9	535.8	193.11	529.4	213.07	561.62	199.49
14.000	794.9	662.6	246.57	668.3	279.83	616.90	309.68
15.000	880.0	821.7	344.92	856.0	400.01	681.83	455.09
16.000	879.2	855.2	269.04	854.1	312.87	709.27	463.76
17.000	913.1	939.5	263.73	929.0	309.70	751.90	527.82
18.000	979.2	1071.6	324.61	1075.9	385.29	808.78	643.83
19.000	993.8	1126.8	278.91	1106.8	334.07	842.71	676.19
20.000	1068.4	1270.5	355.92	1271.4	426.85	903.06	804.86

TIME E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00
[illegible]	193.72	242.5	54.53	40.94	127.26	138.4	113.35
[illegible].000	112.27	189.3	37.87	2.99	65.25	132.9	90.21
[illegible].000	107.45	186.3	36.89	0.74	61.53	129.6	88.34
[illegible].000	102.33	165.2	30.11	-14.69	36.36	107.0	79.43
[illegible].000	120.00	158.3	28.00	-19.50	28.50	104.0	76.50
[illegible].000	106.35	131.8	19.58	-38.67	-2.33	239.9	64.81
[illegible].000	228.02	192.2	51.64	4.74	68.10	387.5	91.23
[illegible].000	161.38	130.9	45.28	-6.36	-3.95	406.9	64.39
[illegible].000	220.08	150.3	64.56	40.94	19.42	511.9	100.11
[illegible].000	354.12	219.3	99.25	123.35	100.16	668.2	157.24
[illegible].000	321.06	179.9	99.76	127.90	83.67	710.5	166.89
[illegible].000	286.92	226.7	100.05	131.95	48.36	752.2	176.24
[illegible].000	324.10	319.6	114.93	169.23	97.35	842.4	205.05
[illegible].000	357.08	309.8	123.95	204.55	143.11	929.8	234.26
[illegible].000	427.93	324.6	160.71	257.51	217.77	1043.0	273.43
[illegible].000	548.39	371.7	182.70	333.77	330.46	1190.3	326.31
[illegible].000	475.04	343.2	175.90	319.60	295.87	1205.3	325.65
[illegible].000	460.91	369.5	183.37	342.06	329.19	1278.2	345.62
[illegible].000	583.02	385.6	206.82	398.37	401.36	1392.7	387.14
[illegible].000	529.49	423.1	215.99	400.37	391.83	1430.6	394.63
[illegible].000	[illegible]	460.9	233.12	465.55	496.17	1581.7	441.56

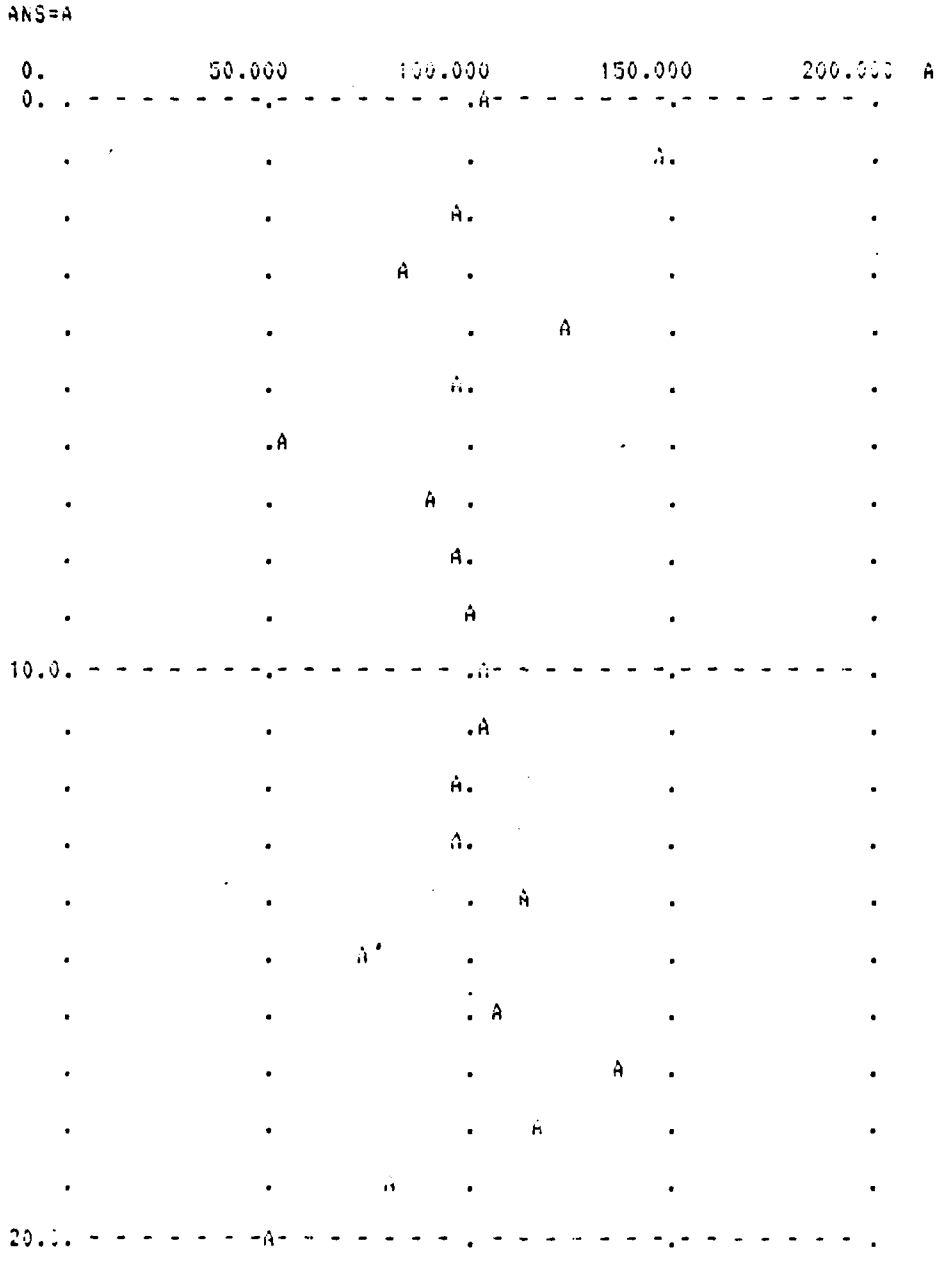
ANS=A



```
DYNAMO - T. VERSION 4.11     05/07/80    13.17

 *  ANS1

 L  PROB.K=PROB.J+(DT)(RATE.JK)

 N  PROB=10

 R  RATE.KL=PROB.K+ANS.K

 A  ANS.K=102+(FN.K)(SIN((6.28*TIME.K)/FF.K))

 A  FN.K=17+(NOISE()*85)

 A  FF.K=4+(NOISE()*1)

 SPEC  DT=.1/LENGTH=20/PRTPER=1/PLTPER=1

 PRINT  ANS

 PLOT  ANS=A

 RUN

  TIME      ANS
  E+00     E+00
 0.       102.00
 1.000    146.48
 2.000     97.22
 3.000     62.66
 4.000    121.73
 5.000     [illegible]
 6.000     54.2e
 7.000     89.23
 8.000     97.95
 9.000     99.9e
10.000    102.59
11.000    102.23
12.000     96.57
13.000     96.14
14.000    112.57
15.000     74.93
16.000    105.59
17.000    136.01
18.000    116.90
19.000     78.97
20.000     48.46
```

TIME E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00
0.	287.00	263.00	63.00	70.00	29.00	160.00	39.000
1.000	319.68	358.42	113.55	109.24	143.62	287.45	37.323
2.000	307.72	413.91	104.79	134.94	47.23	333.10	61.652
3.000	305.23	430.72	64.26	139.58	-16.42	288.33	42.219
4.000	312.06	417.04	8.93	121.19	20.33	86.54	9.279
5.000	290.04	368.32	28.63	88.13	45.09	30.26	-7.569
6.000	287.46	282.44	37.76	41.14	1.69	24.51	60.722
7.000	272.37	234.63	106.65	15.97	39.81	63.19	96.730
8.000	247.71	178.11	93.12	2.74	-35.63	216.40	32.211
9.000	290.00	155.50	64.72	7.59	-42.41	272.16	46.956
10.000	285.04	141.80	25.63	31.69	10.41	330.46	-8.276
11.000	307.45	224.95	40.92	84.19	-99.62	80.01	17.412
12.000	272.91	234.59	66.81	107.51	35.87	128.98	68.079
13.000	316.88	380.77	115.20	139.73	132.73	13.81	16.505
14.000	296.41	251.09	107.16	138.90	113.12	124.65	-26.077
15.000	336.89	373.59	91.73	132.10	-95.50	-22.58	68.705
16.000	263.10	412.44	32.66	92.87	58.78	108.20	25.420
17.000	278.80	432.72	13.60	51.43	115.43	271.14	-26.040
18.000	307.39	338.77	73.60	16.27	-15.73	301.29	95.520
19.000	271.10	256.46	122.87	-2.81	125.19	155.33	5.153
20.000	278.02	241.77	83.21	-1.89	-7.07	327.51	-10.065

TIME E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00
0.	31.00	126.00	275.00	275.00	166.00	236.00	108.00
1.000	77.10	172.78	332.66	317.39	185.00	319.34	8.60
2.000	95.61	207.76	331.75	323.34	188.83	367.61	6.12
3.000	99.23	216.87	300.51	319.27	187.01	372.54	-12.99
4.000	97.22	205.94	234.52	309.52	179.29	325.97	-1.63
5.000	51.27	176.99	236.72	274.64	165.57	264.39	112.44
6.000	-1.62	102.02	227.24	214.33	135.40	135.49	-59.25
7.000	-4.56	94.19	279.17	236.47	147.12	126.92	202.36
8.000	-7.00	60.22	306.88	259.25	156.90	117.47	83.48
9.000	-16.83	48.66	316.22	260.28	157.96	122.01	109.95
10.000	-17.04	39.69	297.02	274.29	165.33	161.51	130.24
11.000	31.15	107.34	211.00	336.08	198.07	327.83	191.77
12.000	33.35	98.70	247.07	278.71	170.71	304.37	183.22
13.000	101.88	199.83	253.21	323.57	183.23	375.53	221.80
14.000	55.29	93.43	244.24	305.98	183.64	344.69	192.18
15.000	127.26	174.33	316.88	289.68	178.39	390.31	271.21
16.000	69.51	203.53	312.33	265.66	161.09	288.16	21.45
17.000	75.87	219.20	307.18	216.76	139.68	203.00	-17.71
18.000	24.42	154.46	257.62	272.06	162.06	136.28	60.88
19.000	-41.55	98.70	200.10	241.47	156.36	86.32	211.96
20.000	-18.53	175.44	195.79	253.45	148.13	79.22	-28.61


ANS=A
0.
50.000
100.000
150.000
200.000
A
10.0.
20.0.

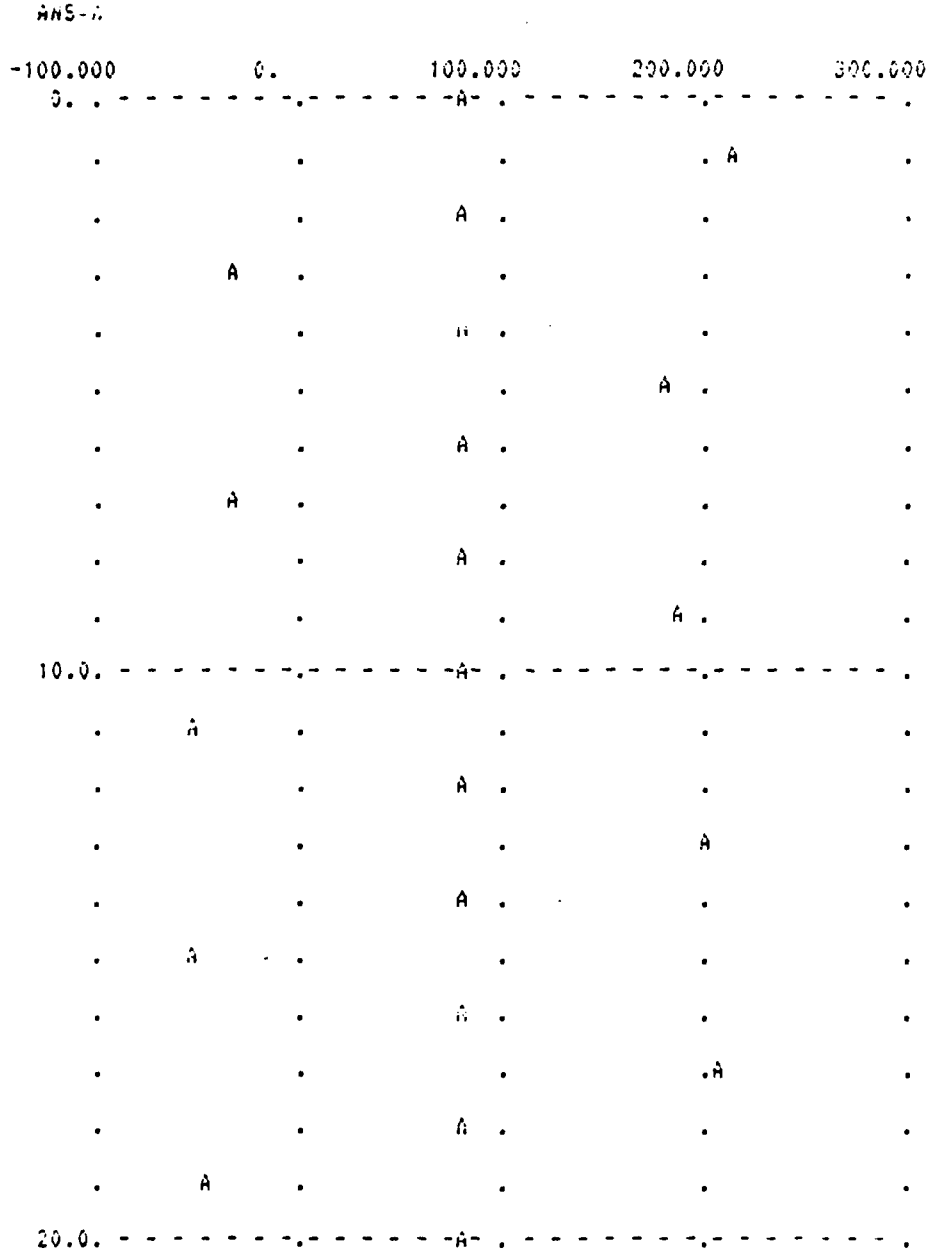
```
DYNAMO - P. VERSION 4.11      05/07/80      13.
```

```
*  ANSI

L  PROB.K=PROB.J+(DT)(RATE.JK)

N  PROB=10

R  RATE.KL=PROB.K*ANS.K

A  ANS.K=81+(FM.K)(SIN((6.28*TIME.K)/FF.K))

A  FM.K=114+(NOISE()*47)

A  FF.K=4+(NOISE()*0)

SPEC  DT=.1/LENGTH=20/PRTPER=1/PLTPER=1

PRINT  ANS

PLOT  ANS=A

RUN
```

TIME E+00	ANS E+00
0.	81.00
1.000	210.19
2.000	81.19
3.000	-34.30
4.000	80.60
5.000	182.00
6.000	81.66
7.000	-30.96
8.000	80.37
9.000	184.17
10.000	81.85
11.000	-52.56
12.000	80.12
13.000	202.59
14.000	82.28
15.000	-54.28
16.000	79.73
17.000	201.61
18.000	82.32
19.000	-49.[illegible]
20.000	78.8[illegible]

TIME E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00
0.	104.00	49.000	114.00	2.000	333.00	339.00	87.00
1.000	193.34	90.862	216.20	11.082	429.25	482.40	139.12
2.000	88.98	44.498	93.59	0.780	299.52	383.51	73.89
3.000	34.28	30.817	15.79	0.319	259.35	314.06	60.75
4.000	147.59	67.757	165.99	8.873	417.50	468.07	129.92
5.000	153.39	42.916	207.73	-3.734	382.69	443.12	86.94
6.000	22.82	4.070	29.91	-9.709	287.78	284.99	28.38
7.000	41.04	37.026	19.65	2.119	273.48	233.77	69.61
8.000	124.48	45.185	154.52	-3.431	372.10	423.57	84.57
9.000	157.01	47.084	208.73	-2.537	387.43	448.03	91.45
10.000	111.52	49.556	126.38	1.340	348.02	367.35	89.78
11.000	104.42	49.218	114.46	12.773	430.43	479.60	143.85
12.000	113.17	43.889	136.48	-3.147	351.26	336.04	79.11
13.000	89.00	43.485	94.91	-1.750	290.40	239.50	58.62
14.000	164.04	58.949	205.86	2.245	370.06	297.86	80.01
15.000	56.20	23.520	63.25	7.333	378.92	404.53	114.45
16.000	84.20	52.380	75.23	6.815	296.82	261.35	88.70
17.000	184.57	81.007	213.50	7.865	416.72	469.61	127.07
18.000	79.82	63.025	54.04	12.668	296.33	243.57	103.70
19.000	59.10	27.324	63.59	7.828	391.60	425.44	119.51
20.000	7.67	-1.376	10.46	0.784	321.78	322.88	80.39

TIME E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00	ANS E+00
0.	229.00	201.00	370.00	135.00	175.00	351.00	165.00
1.000	243.25	248.82	475.43	223.45	230.04	532.50	297.39
2.000	229.01	192.07	351.20	121.30	166.85	351.28	117.95
3.000	226.87	158.57	281.56	72.66	133.34	174.53	61.00
4.000	228.96	224.92	422.15	177.39	201.13	350.43	281.79
5.000	218.66	237.76	440.72	170.40	192.72	522.30	238.68
6.000	229.10	159.98	277.13	51.45	121.99	351.88	35.41
7.000	229.86	161.11	288.24	80.76	143.83	175.78	80.20
8.000	229.07	216.70	399.88	149.09	181.79	349.91	223.44
9.000	220.81	238.82	443.95	175.13	196.03	523.19	244.82
10.000	228.96	206.07	380.14	141.07	170.34	352.38	186.72
11.000	210.92	201.22	370.49	135.43	175.27	167.92	298.20
12.000	229.17	209.23	384.83	139.74	176.56	349.39	193.63
13.000	236.62	192.44	351.66	120.85	166.42	529.74	77.78
14.000	228.98	239.56	448.60	186.05	204.09	352.95	132.21
15.000	209.48	176.50	314.91	86.25	144.21	167.33	227.65
16.000	229.15	185.93	341.25	121.24	168.30	348.82	111.03
17.000	238.39	246.16	467.53	212.12	222.14	530.46	281.20
18.000	228.74	179.10	330.67	122.77	171.13	353.41	107.33
19.000	213.60	177.25	317.40	90.32	147.09	169.05	245.45
20.000	228.70	151.28	258.54	37.21	113.37	348.08	149.68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APPENDIX J

MATCHED PAIRS FOR T-TEST OF MAD, GENERATED DATA, NORMAL AND TREND

This appendix lists the matched pairs used in the T-Tests. In each case the D062 Mean Absolute Deviation (MAD) was adjusted to 100, and the adjusted focus forecast MAD was set to a percentage of the adjusted D062 MAD. Thus, an adjusted focus forecast MAD less than 100 shows decreased deviation from actual demand when compared to the D062 forecasting method. Where output for two types of generated data are depicted, data are listed in groups of fifteen.

MATCHED PAIRS FOR T-TEST OF MAD, GENERATED DATA, NORMAL AND TREND

D062 MAD	FOCUS FORECAST MAD	ADJUSTED D062 MAD	ADJUSTED FOCUS FORECAST MAD
54.70	77.30	100.00	141.30
19.60	27.90	100.00	142.30
37.00	51.00	100.00	137.80
99.10	100.40	100.00	101.30
74.90	76.70	100.00	102.40
39.20	54.30	100.00	138.50
30.40	42.30	100.00	139.10
8.90	11.80	100.00	132.60
39.10	54.80	100.00	140.20
36.20	49.80	100.00	137.60
52.90	49.30	100.00	93.20
0.30	0.10	100.00	33.30
77.70	91.30	100.00	118.10
9.70	13.20	100.00	136.10
40.10	55.30	100.00	137.90
2245.50	180.40	100.00	8.00
1071.40	82.20	100.00	7.70
1738.70	249.70	100.00	14.40
322.00	123.90	100.00	38.50
1909.30	669.00	100.00	35.00
541.20	169.20	100.00	31.30
1108.80	68.80	100.00	6.20
1156.10	573.40	100.00	49.60
705.50	210.70	100.00	29.90
1327.70	239.70	100.00	18.00
304.40	64.70	100.00	21.30
724.30	174.80	100.00	24.10
620.50	304.80	100.00	49.10
2021.10	205.30	100.00	10.20
574.40	62.50	100.00	10.90

MATCHED PAIRS FOR T-TEST OF MAD, GENERATED DATA, SEASONAL AND CYCLICAL

D062 MAD	FOCUS FORECAST MAD	ADJUSTED D062 MAD	ADJUSTED FOCUS FORECAST MAD
60.20	52.70	100.00	87.50
82.20	60.30	100.00	73.30
143.80	138.40	100.00	96.20
45.70	40.10	100.00	87.70
226.60	126.00	100.00	55.60
84.80	117.70	100.00	138.80
401.80	388.40	100.00	96.70
28.20	38.40	100.00	136.20
395.40	278.20	100.00	70.40
195.10	184.90	100.00	94.80
230.10	343.20	100.00	149.20
146.40	109.50	100.00	74.80
111.80	97.70	100.00	87.40
56.10	47.70	100.00	85.00
343.30	179.60	100.00	52.30
15.10	19.30	100.00	127.80
59.30	52.90	100.00	89.20
25.80	36.60	100.00	141.90
96.80	71.00	100.00	73.30
12.50	9.60	100.00	76.80
76.10	83.50	100.00	109.70
128.70	139.10	100.00	108.10
55.80	34.90	100.00	62.50
7.80	9.00	100.00	115.40
39.90	32.40	100.00	81.20
79.70	70.30	100.00	88.20
48.60	34.80	100.00	71.60
3.30	3.80	100.00	115.20
105.10	97.30	100.00	92.60
26.80	26.30	100.00	98.10

MATCHED PAIRS FOR T-TEST OF MAD, ACTUAL DATA

D062 MAD	FOCUS FORECAST MAD	ADJUSTED D062 MAD	ADJUSTED FOCUS FORECAST MAD
1240.50	1382.00	100.00	111.40
11.70	10.00	100.00	85.40
842.10	525.70	100.00	62.40
742.10	390.60	100.00	52.60
485.60	153.40	100.00	31.50
511.30	282.70	100.00	55.20
258.80	326.50	100.00	126.10
11.80	12.80	100.00	108.40
11.70	10.00	100.00	85.40
45.60	45.40	100.00	99.50
186.20	258.20	100.00	138.60
1175.70	893.60	100.00	76.00
845.70	820.80	100.00	97.00
12.80	12.80	100.00	100.00
21.10	28.00	100.00	132.70
137.90	144.40	100.00	104.70
2041.30	1279.60	100.00	62.60
29.10	37.30	100.00	128.10
134.60	35.90	100.00	26.60
889.30	605.20	100.00	68.00
636.20	472.20	100.00	74.20
4.10	3.20	100.00	78.00
8.30	5.20	100.00	62.60
10.60	8.10	100.00	76.40
11.10	12.00	100.00	108.10
76.90	65.00	100.00	84.50
417.60	247.10	100.00	59.10
34.70	18.10	100.00	52.10
70.30	77.90	100.00	110.80
213.50	93.70	100.00	43.80
205.30	117.80	100.00	57.30
9.50	8.70	100.00	91.50
8.30	12.20	100.00	146.90
418.40	105.60	100.00	25.20

MATCHED PAIRS FOR T-TEST OF MAD, ACTUAL DATA (CONTINUED)

D062 MAD	FOCUS FORECAST MAD	ADJUSTED D062 MAD	ADJUSTED FOCUS FORECAST MAD
235.10	137.00	100.00	58.20
31.10	29.70	100.00	95.40
2.60	2.10	100.00	80.70
288.60	79.20	100.00	27.40
102.40	171.80	100.00	167.70
441.90	410.20	100.00	92.80
352.90	246.00	100.00	64.20
42.80	31.70	100.00	74.00
124.00	148.20	100.00	119.50
1382.20	1490.30	100.00	107.80
497.70	321.50	100.00	64.50
1302.80	1164.90	100.00	89.40
3510.20	1873.80	100.00	53.30
30340.10	18167.70	100.00	59.80
1295.60	737.90	100.00	56.90
67.60	56.00	100.00	82.80
119.70	187.20	100.00	156.30
198.30	78.00	100.00	39.30
57.40	45.40	100.00	79.09
47.20	43.70	100.00	92.50
879.20	1592.90	100.00	181.10
680.80	396.60	100.00	58.20
170.20	280.80	100.00	164.90
64.30	86.10	100.00	133.90
128.30	106.00	100.00	82.60
58.40	24.90	100.00	42.60
95.10	621.10	100.00	65.20
74.70	95.40	100.00	127.70
4777.30	2491.60	100.00	52.10
99593.60	52142.60	100.00	52.30
44.40	21.80	100.00	49.10
572.20	121.90	100.00	21.30
550.00	72.90	100.00	13.30

APPENDIX K

Item Number to Stock Number Cross Reference

Item #	Stock #	Item #	Stock #
1	1650000249665	34	1560006527618FL
2	1650000670183	35	1560006702424FL
3	1650002277649	36	1560007315439FL
4	1650004087599	37	1560007789417FL
5	1650004846911	38	1560008632693FL
6	1650006120297	39	1560009530858FL
7	1650006703447	40	7110006317617FL
8	1650006927488	41	4720003452285FL
9	1650007983136	42	5310009605920FL
10	1650007989768	43	5330005719350FL
11	1650007989771	44	4820005293494HS
12	1650009380124	45	1670000354606
13	1660003486524	46	1670003349760
14	1660004910929	47	1670005298712
15	1660005254089	48	1670005544743
16	1660008127329	49	1670005614421
17	1660008872964	50	1670007251437
18	2945007531454	51	1670008333311
19	6605000641386	52	1670008355952
20	6610008248616	53	1680004855020
21	6620005265581	54	1680006747580
22	6620009023688	55	1680007531346
23	1560000535106FL	56	1680009614666
24	1560003409383FL	57	1730000157963
25	1560005366180FL	58	1730000308387
26	1560005665759FL	59	1730002124500
27	1560005749699	60	1730003869513
28	1560006102612FL	61	1730004923722
29	1560006117608FL	62	1730006058818
30	1560006118913FL	63	1730006139999
31	1560006279194FL	64	5306002079593
32	1560006301722FL	65	5310009229026
33	1560006317627FL	66	6240010184896
		67	6640001054386

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